MACHINERY

Design—Construction—Operation

Volume 41 | MARCH, 1935 | Number 7

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GRAPHIC ARTS INDUSTRY
The Industrial Press

The Automotive Industry has pushed ahead more rapidly toward recovery than any other industrial activity. April MACHINERY will contain a number of articles covering the latest developments in the practice of this industry—developments, the importance of which is not confined to that industry alone, but which will have a decided influence on shop practice in many other industrial fields.

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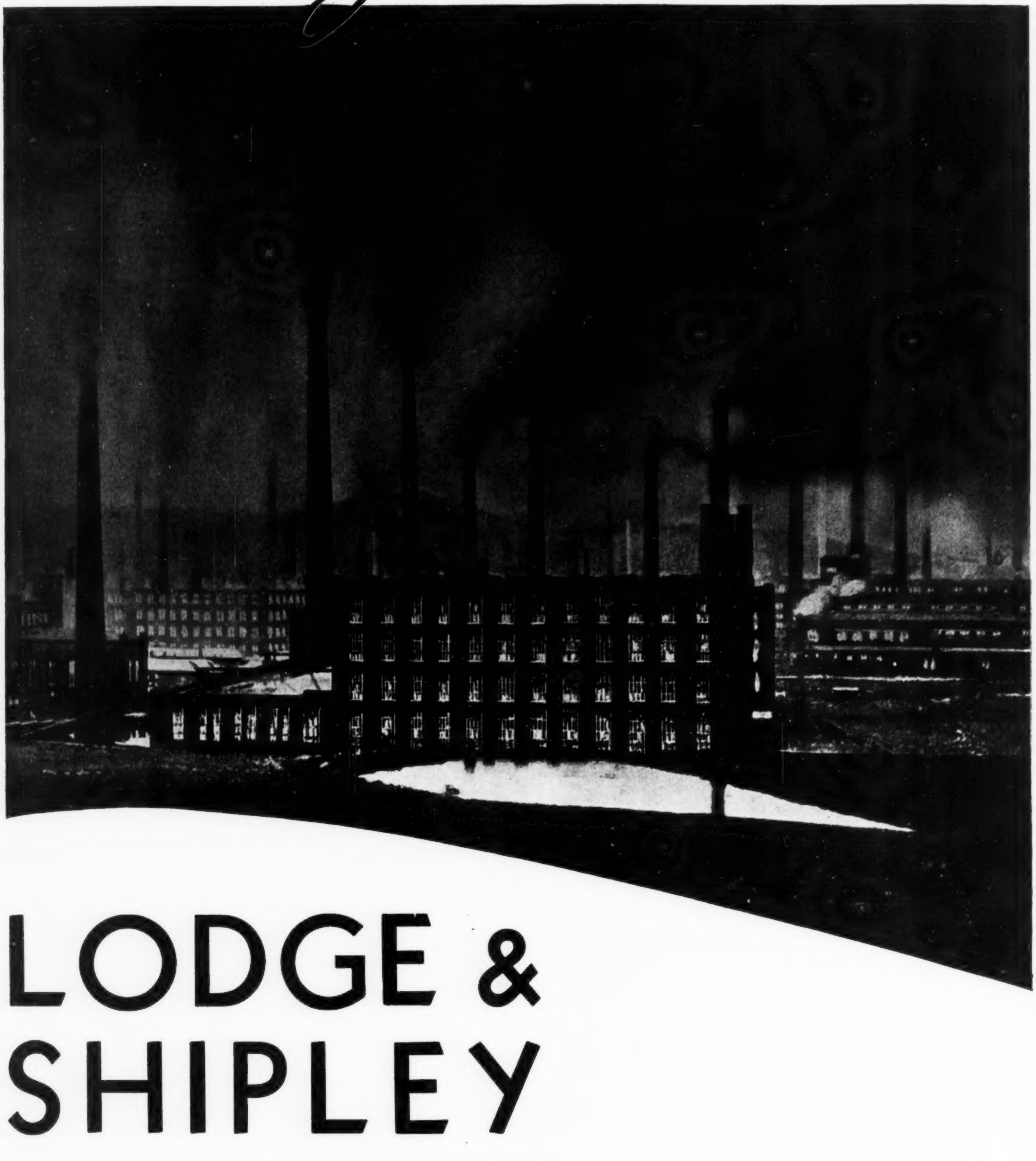
The SMOKE



LODGE & SHIPLEY LATHES

MACHINERY

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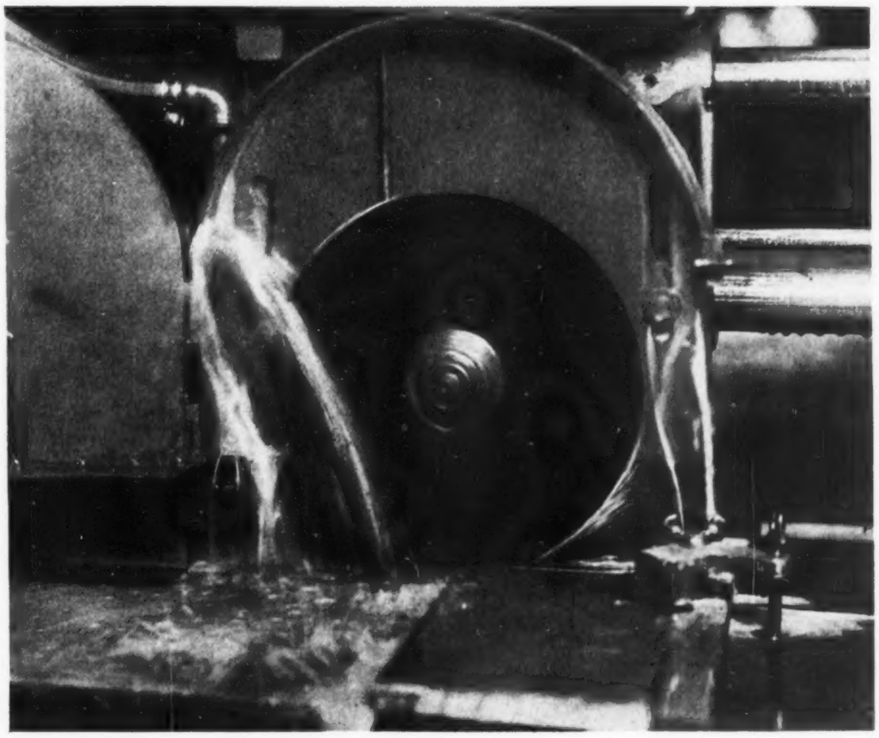
Abrasive Cutting-Off Turns Minutes into Seconds



By HARRY G. ROBINSON
Chief Engineer
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Bridgeport, Conn.

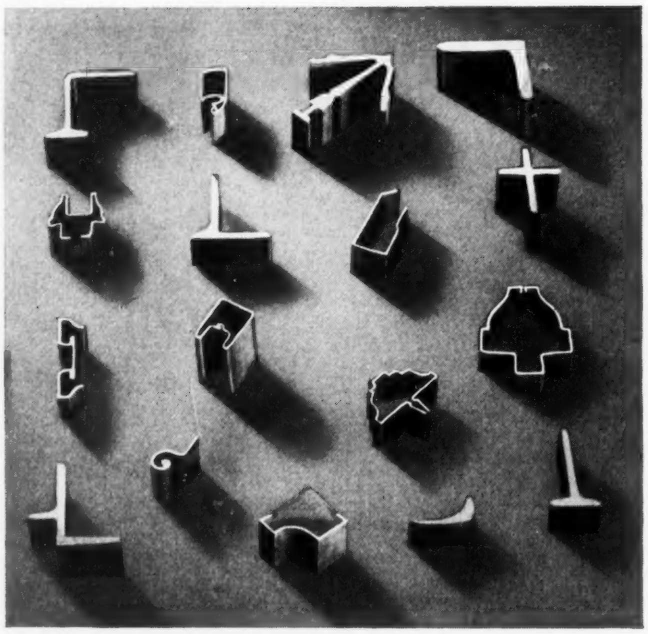
CHISEL steel 1 inch in diameter cut from the bar in 11 seconds; unannealed 18-8 stainless steel rods 2 inches in diameter, cut off in 35 seconds per piece; and even slabs of glass cut in two at the rate of 1 1/2 square inches a minute! Such cutting-off performances as these were unheard of as recently as five years ago, but today they are standard practice in an ever increasing number of industrial plants. Abrasive cutting-off equipment has made this possible.

Abrasive cutting-off is so new that comparatively little has been written concerning its development and advantages. However, the process has now been applied extensively enough to permit the presentation of facts and figures that can serve as a guide in considering its adoption. The information to be given in this article represents the experience of the concern with which the writer is connected. Dry, submerged, and wet cutting-off will all be dealt with.

The first big advantage of the abrasive method of cutting off materials is a tremendous saving in time; stock that requires ten to fifteen minutes by other methods can be cut off abrasively in as many or fewer seconds. This advantage cannot be overemphasized in view of the fact that in most shops considerable time is lost by toolmakers and other high-priced mechanics in waiting for materials from the stock-room. This loss of time should be added to the cost of materials.

Another important advantage of abrasive cutting-off is that pieces can be cut to length within a few thousandths of an inch and with such a high quality of finish on the ends as to eliminate the necessity of straddle-milling or grinding operations. Still another advantage is that the abrasive wheel will cut right through any hard spots that may be encountered without difficulty. Unannealed steel can be cut at the same cost as annealed steel, and when unannealed material can be used, a saving of from one to two cents per pound can be made.

All kinds of materials can be cut off by the abra-



Sections of Any Shape, whether Made of Brass, Bronze, Steel, Monel Metal, or Almost Any Other Material, Can be Cut Off Abrasively in a Few Seconds

sive method, including brass, bronze, steel, Monel metal, ceramics, phenolic plastics, glass, and even tungsten and tantalum carbide. Aluminum-oxide wheels are most successful for steel and non-ferrous metals; silicon-carbide wheels for glass, porcelain, phenolic plastics, hard rubber, and similar materials; and diamond-impregnated wheels for tungsten and tantalum carbide and exceptionally hard natural materials, such as Brazilian quartz.

Rubber-bonded wheels seem to give the best results at the present stage of wet abrasive cutting-off, but there is every reason to believe that resinous-bonded wheels can also be developed to be just as satisfactory. Abrasive cutting-off wheels are available as thin as 0.015 inch, while the maximum thickness is about 1/4 inch. They are generally used in diameters of 10 or 16 inches.

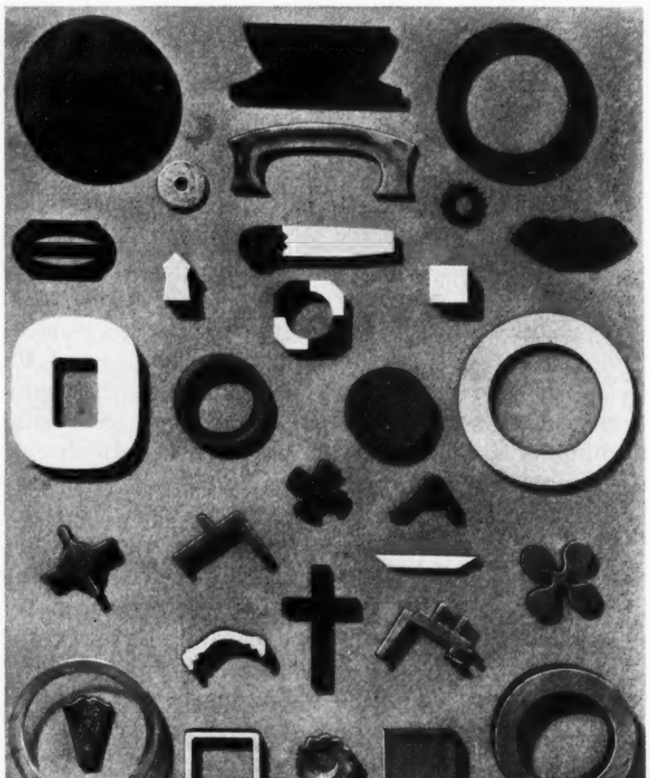
Abrasive Cutting-Off was First Performed Dry

In the early days of abrasive cutting-off, all operations were performed dry. Resinous-bonded wheels were the most successful at first, but their life could not compare with the life of present-day wheels. For example, a 12-inch wheel in the early days, costing about $1.28, would last for about 90 cuts on 1-inch cold-rolled steel bars. Under similar conditions today, a wheel costing about the same would last for approximately 125 cuts. However, dry cutting-off is no longer recommended for this material, as will be later explained.

Economy can be attained in dry abrasive cutting-off on most materials only by running the wheel at a speed high enough to heat the material sufficiently so that the action of the wheel becomes comparable to that of a steel friction cutting-off disk. Otherwise, the wheel would wear out too rapidly. It is for this reason that dry cutting-off machines are built to drive the abrasive wheel at speeds of 15,000 or 16,000 surface feet a minute.

When observed under the microscope, the minute chips obtained in dry abrasive cutting-off are found to be solidified globules of steel that were apparently in a molten or near molten condition as they were separated from the material being cut. They indicate the high temperature of the material resulting from the action of the fast-running wheel.

Machines of two different types have been developed for cutting bars and flat sheets or plates by the dry abrasive method. On the Model 20 machine, the wheel is fed vertically by hand through the bar or rod being cut off, while on the Model 30, the wheel is fed horizontally. Both of these machines were designed to provide maximum rigidity, so as to insure a true-running abrasive wheel. Another feature of the dry machines is the complete absence of slide bearings, which eliminates bearing troubles due to abrasive dust. These principles have been closely observed in designing later equipment.



Glass, Porcelain, Bakelite, Stone, Steel Tubing and Other Materials are Cut Off Economically by Either the Submerged or Wet Abrasive Methods

Present-Day Applications of the Dry Abrasive Cutting-Off Process

Dry abrasive cutting-off is still preferable for materials that can be cut off most efficiently when there is heat between the metal and wheel, but most materials are cut off more advantageously by using a coolant. A typical operation in which dry abrasive cutting-off excels is on solid nickel anodes having an oval cross-section about 2 3/4 inches long by 1 1/4 inches wide. These anodes are cut from the bar at the rate of fifteen seconds apiece. A 14-inch wheel, 1/8 inch thick, of the proper grain and bonded structure lasts for 60 to 65 cuts.

The horizontally fed Model 30 machine has been of especial value to the manufacturers of paper knives. These knives vary in size up to 7 inches wide and 3/4 inch thick. They are generally made with a hardened steel cutting edge welded to a backing of soft steel. The previous method of cutting these knives from the stock was to use a hacksaw on the mild steel, then nick the hardened steel edge with an abrasive wheel, and break it off. Considerable material—as much as 3/4 inch—had to be left on the ends of the knives to insure good ends, and it was necessary to grind off this excess stock.

In Submerged Cutting-off, the Work and the Bottom of the Abrasive Wheel are in the Coolant

With the present method, the material is positioned accurately in the abrasive cutting-off machine and knife blades are cut off in from five to fifteen seconds, the length being so accurate that no further machining is required. Large savings in time and material are therefore obtained. The same machine is used extensively on stainless steel sheets.

Both rubber- and resinous-bonded wheels are being used in these operations, the former type on comparatively thin stock and the latter on the thicker materials. One of the primary principles to be observed in applying abrasive cutting-off to any job is that the smaller the area of contact between the wheel and the material, the more efficiently the operation will be performed and the longer the abrasive wheel will last.

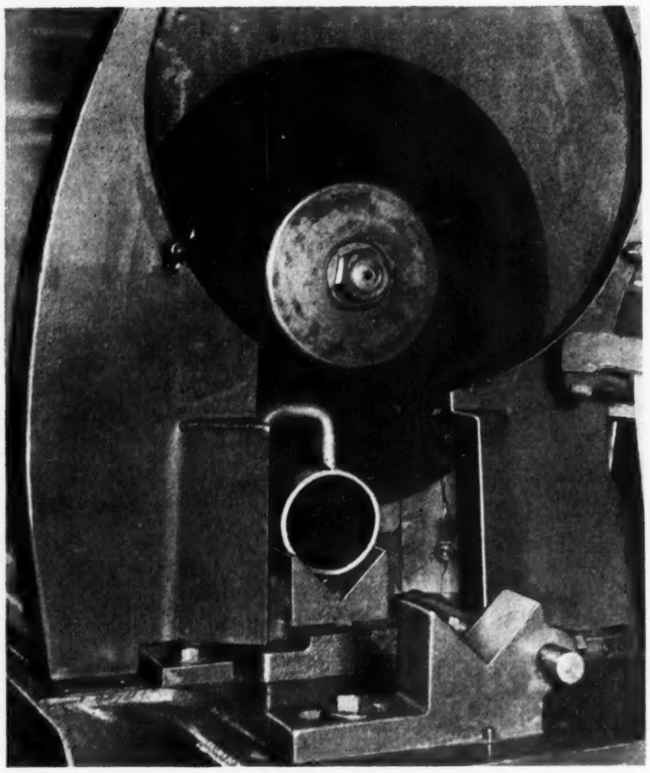
Widened application of abrasive cutting-off led to the discovery of characteristics inherent in the dry method that are somewhat undesirable for many materials. First, considerable difficulty was found in producing wheels sufficiently true in physical dimensions or uniform enough in density so that they could be run at high surface speeds without wabbling or without danger of flying apart. If a wheel is only a little out of balance, the resulting wabble will produce a cut considerably wider than the thickness of the wheel.

A second disadvantage of dry abrasive cutting-off is the difficulty of controlling the dust created. This makes the dry method unsuitable for use in the open factory room, because of the danger to the health of employes. Another disadvantage is that rubber-bonded wheels, which are more easily manufactured and hence cheaper than resinous-bonded wheels, do not withstand the high heat generated by the dry method. A fourth undesirable characteristic is that the cost of the wheel per cut on some materials is comparatively high.

Also, even though the abrasive wheel is thoroughly guarded, its speed is so high that the operator is inclined to feel timid and not apply sufficient pressure in feeding the wheel. As a result, the wheel may glaze, which leads to breakage. On the other hand, if the operator should try to jam the wheel too fast through the work, the abrasive grains will be torn from the bond before they have accomplished their full duty of cutting. This, of course, means high wheel cost.

After the successful application of dry abrasive cutting-off to metals, different companies submitted a wide variety of other materials, including glass, fire-brick, building brick, molded plastics, and Brazilian quartz to be cut off. It was found that these materials could not be cut with the same speed and degree of finish as steel and non-ferrous metals. Experiments finally indicated the need of a machine in which the heat of the material and of the abrasive wheel would be reduced to a minimum. This led to the development of the Hudorkut machine, in which the work is completely submerged in a coolant, as well as that portion of the abrasive wheel engaged in the actual cutting.

Ordinary Steel Bar, 2 1/2 Inches Square, Being Cut Off Dry in Twenty Seconds



Cutting-off Machine of Wet Abrasive Type Set Up for an Operation on Steel Tubing

The first big advantage derived from this method of cutting off was the fact that the wheel speed could be reduced to about 6000 surface feet a minute. It was also found that with the practical elimination of heat in the cutting-off operation, rubber-bonded abrasive wheels could be used advantageously. These wheels can be made strong enough to hold the grains in place until they become dull, and at the same time, soft enough to permit the grains to free themselves and be discarded when they have outlasted their usefulness.

Peculiarly enough, when these facts had been proved true for the variety of materials that led to the submerged type of machine, they were found equally true for steel and non-ferrous metals. The finish obtained with submerged abrasive cutting-off is far superior to that produced by the dry method. Steel pieces cut off by the submerged method are smooth enough to permit deep etching by the metallurgist without any further preparation. This makes the Hudorkut machine suitable for laboratory work.

The Hudorkut machine is provided with a mechanical arrangement for feeding the abrasive wheel vertically through the material being cut. By means of a weight and a dashpot, the feed is automatically varied as the abrasive wheel progresses through the stock, so that as the area of contact between the wheel and the work increases toward the center of a round bar, for example, the rate of feed gradually decreases. From the center of the bar to the end of the cut, the feed is again increased gradually. The cut-off pieces have a "white metal" appearance, there being no indication of burning, and as heat is practically eliminated, very little burr is produced.

Longer Wheel Life in Submerged Abrasive Cutting-Off

The life of the abrasive wheel in submerged cutting-off is from three to four times that of a wheel used in the dry method. In the case of 1-inch octagon-shaped chisel steel, for example, approximately 500 cuts can be taken with a 14-inch rubber-bonded wheel 1/16 inch thick, or from 2800 to 3000 on 1/2-inch chisel steel. Paradoxical as it may seem the higher the carbon content of the steel, within certain limits, the more readily can it be cut abrasively, and so chisel steel can actually be cut more easily than cold-rolled steel. On cold-rolled steel 1-inch in diameter, a 14-inch wheel 1/16 inch thick will last for approximately 400 cuts. The time per cut will be about twenty seconds. Fused quartz 1-inch square can be cut through in 1 1/4 minutes, and a 14-inch wheel will last for about 150 cuts in such an operation.

When viewed under the microscope, the chips produced in submerged abrasive cutting-off are of a curling white-metal type, similar to drill or lathe

chips. They have no appearance of being burned, and are entirely different from the cooled globules of molten metal obtained in dry abrasive cutting-off. In the submerged method, cuts are ordinarily made within length tolerances of plus or minus 0.005 inch, but closer tolerances can be obtained with special set-ups. Plain water is generally used as a coolant, although soluble oil or soda mixed with water is sometimes used. Submerged cutting-off has greatly reduced wheel problems.

Wet Abrasive Cutting-Off Meets Production Requirements

Cuts of highest quality are made on practically all kinds of materials by the submerged method, but the loading of the machine is delayed somewhat by characteristics inherent in its design. This led to the development of the Models 202 and 203 machines, on which bars and other shapes are cut by feeding the abrasive wheel vertically. Both models are identical, except that on one, the work is automatically clamped, while on the other, the clamps are actuated by means of a foot-treadle.

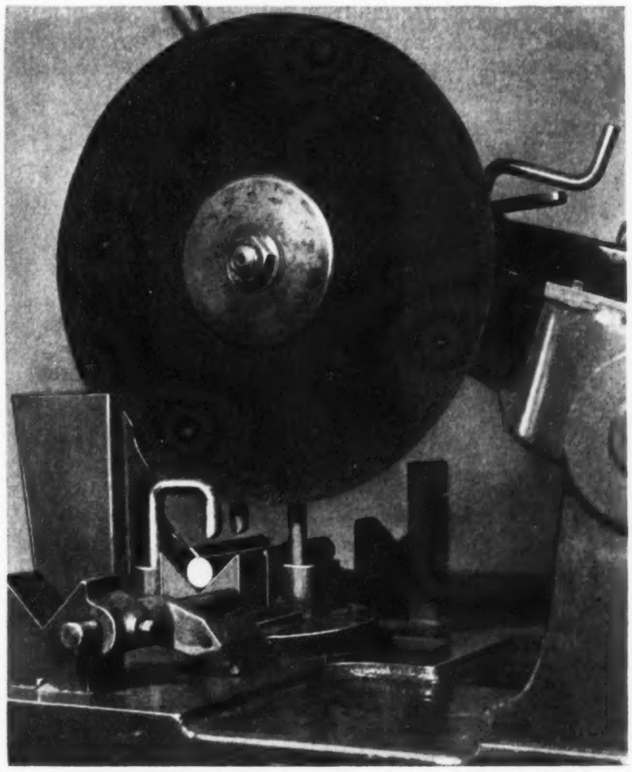
The distinguishing feature of these machines is a "coolant box," which consists of a closed container with a narrow slot through which the abrasive wheel revolves. This container is kept filled with coolant either by direct connection to a supply system or by a volume type of pump, no pressure being necessary. As the abrasive wheel passes through the top of the box, it picks up a certain amount of coolant on the sides and the edge and hurls this coolant into the cut with considerable velocity. The coolant tends to prevent the generation of heat and absorbs the heat that is developed. The effectiveness of this method is proved by the fact that thin-wall tubing is cut off clean, with practically no burrs, showing that the metal is actually cut off rather than being partially heated and then pushed through while in a softened condition.

Pieces of 18-8 stainless steel, 3/4-inch in diameter, are cut off by the wet abrasive method at the rate of six or seven seconds apiece, and a 16-inch rubber-bonded wheel usually lasts for 500 cuts. Bars of the same material, 1-inch in diameter, are cut in eleven seconds, and a 16-inch wheel lasts for about 250 cuts. Two-inch 18-8 stainless steel is cut through in about thirty-five seconds and a 16-inch wheel lasts for approximately 70 cuts. In cutting off cold-rolled steel 1-inch in diameter, about eight seconds is required per piece, and a 16-inch wheel lasts for approximately 450 pieces.

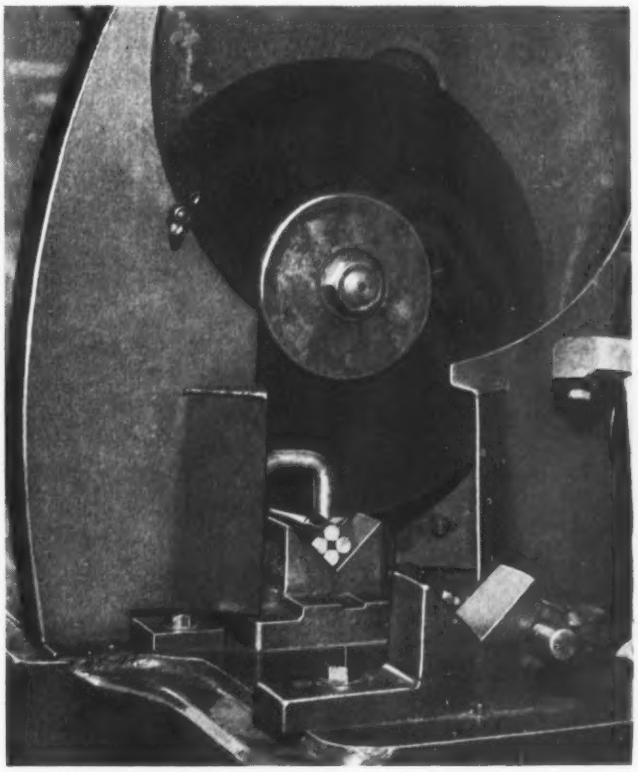
Cutting Slabs of Steel, Glass, and Other Materials

The advantages of abrasive cutting-off have been applied to slabs of steel, glass, and other materials

View Showing Arrangement of Coolant Box on a Wet Abrasive Cutting-off Machine



Maximum Economy can Sometimes be Achieved by Cutting Off Bars in Multiple



by the development of a Model 302 machine, which is designed to feed the wheel horizontally across the work any given number of passes and to feed the wheel vertically between successive passes. Cutting can be accomplished on both the forward and return strokes. This type of machine permits close adherence to the fundamental principle of abrasive cutting-off, that is, proper regulation of the area of material in contact with the wheel, so as to obtain maximum cutting efficiency. This machine can be arranged for dry, submerged, or wet cutting.

The heading illustration shows an operation in process on a machine of this type. In cutting a glass slab, say, 1 to 2 inches thick, by either the submerged or wet method, the slab is first clamped securely to the table, and then a rubber-bonded abrasive wheel is positioned to take a cut from 1/16 to 1/8 inch in depth. The wheel is next moved forward horizontally across the slab by hydraulic feed, a suitable pressure being applied to the abrasive wheel. A feed of about 2 feet a minute is generally used.

At the end of this preliminary "scoring" cut, the wheel is lowered from 3/8 to 1/2 inch and a return cut is made across the glass slab, during which the wheel is accurately guided by the groove of the previous cut. This procedure is repeated until the slab has been completely cut in two. At the end of the operation, there is no indication that a series of cuts has been taken, the surfaces of the work appearing as though they had been severed in one pass of the abrasive wheel.

Glass can be cut at the rate of about 1 1/2 square inches a minute. The life of a wheel, in cutting glass, varies between a ratio of 0.15 to 0.25 to 1 with respect to the area of the cut. In other words, for every 4 square inches of glass cut, there is wheel wear amounting to about 1 square inch. Hard spots encountered in cutting glass are compensated for by the feed of the wheel being slowed up automatically with the increased resistance of the material. It seems almost unbelievable that with a wheel as flexible as a 1/16 inch thick, 14-inch diameter abrasive wheel necessarily is, glass slabs, say, 20 inches long can be cut straight and parallel within 0.010 inch. Nevertheless, such is the case.

The procedure in cutting slabs of steel and other materials is the same as that followed in cutting glass, a preliminary scoring cut being taken across the material and then a series of passes until the material has been cut through. However, a different type of wheel is used.

Bars and sections up to 4 inches square have been cut on machines of the type where the wheel moves vertically only, but when the section is wider than 4 inches, it is necessary to employ the slab type of cutting-off machine. Otherwise, the area of contact between the material being cut off and the abrasive wheel would be too great to obtain economical cutting.

Wheel Costs in Abrasive Cutting-Off

Wheel costs in this new method of cutting off materials can be approximated from the examples given, by assuming that the cost of a 16-inch diameter, 1/16-inch thick rubber-bonded aluminum-oxide wheel is about $1.50. The present-day cost of a silicon-carbide wheel of the same dimensions and bond is about $1.70. Prices vary somewhat with different manufacturers. Most abrasive-wheel companies now carry in stock various types of wheels suitable for wet cutting.

A distinct advantage of wet cutting over dry cutting is that an abrasive wheel suitable for wet cutting will cover a much wider range of materials than a wheel designed for dry cutting. This fact is important, as a much smaller selection of wheels is necessary for cutting a given range of materials by the wet method.

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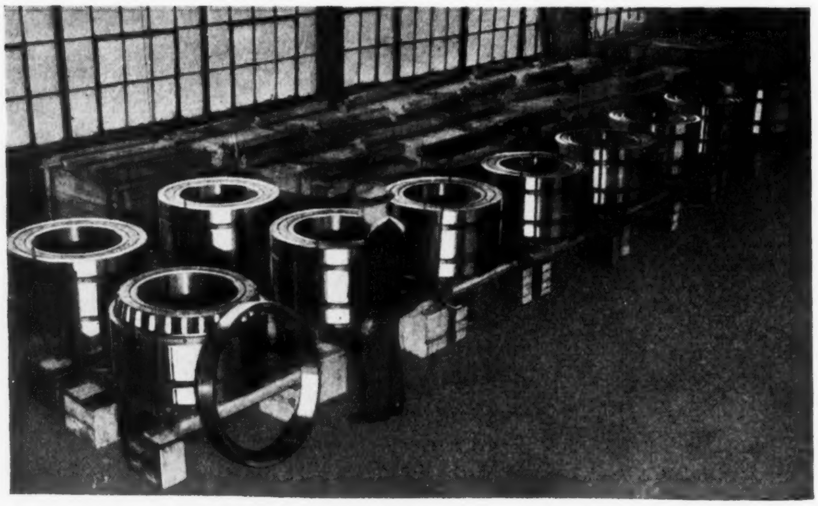
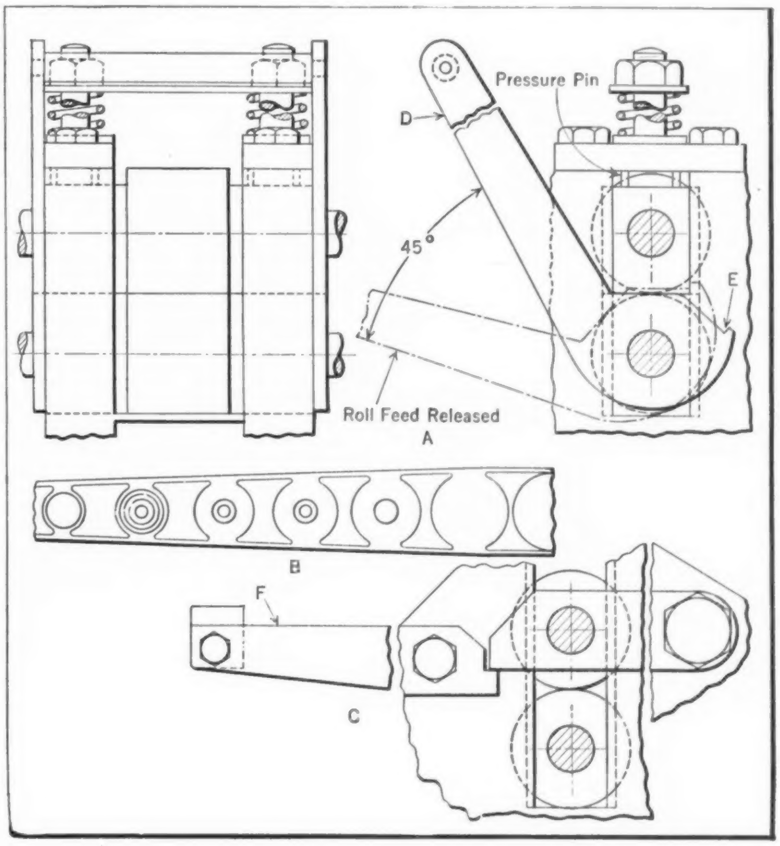


Twenty-three of the 1400 Timken tapered roller bearings that will be used in the new Ford steel mill—in the Timken plant ready for shipment. Fifty-two bearings of the size shown —25 1/2 by 40 1/2 inches—each weighing over 4000 pounds, will be installed on the back-up roll-necks of the four-high hot strip mills and on the tandem cold strip mills. Some bearings, 30 by 47 inches, will weigh over 7600 pounds each. These are used on a single-strand reversing cold mill. In all, 185 tons of Timken bearings are used in the new Ford steel mill

Self-Locking Roll-Feed Release for Presses

By EDWARD LAY

Most power presses are equipped with one roll feed located on the left-hand side of the press. Thus, in starting a new coil of stock in a progressive gang die, the operator feeds the stock in from the right-hand side by hand to complete all the required operations, stroke by stroke, until the roll feed is reached. Then with the improved roll-feed release cam unit shown at *A* in the accompanying illustration, the handle *D* is pressed down as far as it can go. This requires a movement of only 45 degrees as indicated, the lever then being stopped by shoulder *E* at the position shown by the dot-and-dash lines. As the releasing device holds the rolls in the open position, it is a simple matter to pass the scrap stock between the rolls and a few inches beyond them, after which the feed-rolls can be easily engaged by returning the lever *D* to its original position.



(A) Roll Release that Holds Press Feed Rolls Apart for Starting the Stock; (B) Scrap Stock; (C) Old Type Roll Release

The releasing and engaging of the roll feed cannot be done so readily with the standard or regular releasing equipment shown at *C*. Many times the writer has noted the difficulty experienced in releasing rolls with the latter type of equipment. The usual procedure is to hit the lifter arm *F* a blow with a tool of some kind, while attempting to force the stock into the correct position between the rolls. This procedure is also repeated in releasing the stock at the end of the coil.

The new releasing device has proved so much easier and quicker to operate that it has been applied in one plant to all power press roll feeds used with progressive gang dies for doing work similar to that shown at *B*. The construction of the new releasing device shown at *A* is very simple, the releasing cams being pivoted to the lower roll shaft at each end outside of the roll-feed frame. The bearings for the upper roll are free to slide, while those for the lower roll remain fixed.

* * *

Labor's Opportunity to Promote Recovery

The outcome of higher wage rates and shorter working hours, with industry in its present condition, is the most striking reduction in the real income of wage earners in thirty years, according to a booklet published by Allen W. Rucker and N. W. Pickering, president of the Farrel-Birmingham Co., Inc., Ansonia, Conn. This booklet is entitled "Labor's Opportunity to Promote Recovery."

The authors point out that higher wage rates and shorter working hours under present conditions definitely decrease the purchasing power of wages, because of increases in prices. The 1933 Census of Manufactures tells an unsatisfactory story to those wage earners and industrialists who hoped that shorter hours and higher wages, without a corresponding increase in productivity, would increase purchasing power. Artificial increases in wage rates without corresponding increases in production rebound upon those who are supposed to be most benefited, because prices are likely to increase at a more rapid ratio than wage rates.

"If labor will cooperate with industry and government to effect modifications in costs and prices," say the authors, "all else will follow—fair prices to consumers, high annual incomes to workers, and jobs by the millions."

* * *

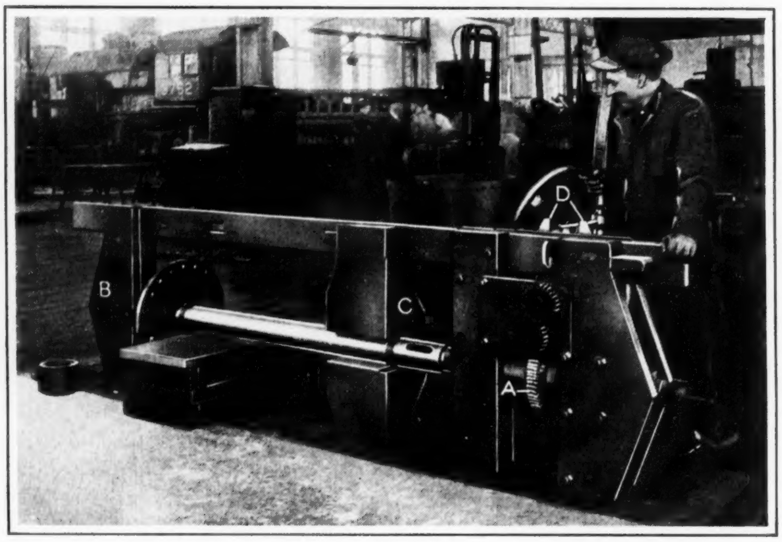
If we were all willing to cooperate for the common welfare instead of fighting for selfish ends, the depression would be over.

Machine for Assembling Locomotive Piston-Heads

By OLIVER HERBERT

A machine built in the Battle Creek, Mich., shops of the Grand Trunk Railway System for assembling locomotive piston-heads on piston-rods and for disassembling these parts, is shown in the accompanying illustration. Power for operating this equipment is obtained from an old air drill mounted on the far side of the frame, close to the operator. Through reduction gears, the power is transmitted to a worm-wheel *A*. This worm-wheel has an internal thread that engages a corresponding thread on a horizontal ram. Hence, when the worm-wheel is rotated, the ram is advanced or withdrawn for assembling or disassembling parts.

When a piston-head part is being assembled, it is slipped loosely on the tapered end of the rod and is then pushed against the heavy upright *B*, as shown. For disassembling operations, the piston-head would be placed against the front face of upright *C* and the piston-rod would be pushed from it.



Air-driven Press Designed for Assembling Locomotive Piston-heads on Their Rods or for Disassembling them

The total movement of the ram is 12 inches. Stops *D* can be set for automatically controlling the piston of the air cylinder when the ram has moved forward or returned the desired amount. A guard ordinarily covers the reduction spur gears and the worm-wheel.

* * *

Chicago Machine Shop Practice Meeting

The Chicago Section of the American Society of Mechanical Engineers will hold a Machine Shop Practice Meeting and Exhibit Thursday afternoon and evening, March 28, in the Engineering Building, 205 W. Wacker Drive, Chicago, Ill. A number of papers of specific interest to the machinery industries have been obtained from men in the machine tool, steel, and metal manufacturing fields. Further information can be obtained from C. B. Cole, Tool Equipment Sales Co., 4625 Fulton St., Chicago, Ill., chairman of the meeting.

Increases in Soviet Production and Trade

According to the *Economic Review of the Soviet Union*, all the important industries in the Soviet Republics have recorded substantial increases during 1934, as compared with 1933, outstanding gains being shown by the metallurgical, automotive, and fuel industries. During 1934, the output of pig iron was 10,500,000 tons and of rolled steel 6,700,000 tons. The production of tractors was 90,700 units, auto trucks 55,000 and passenger cars 17,000. The new ball bearing factories are in operation, and the ball bearings produced numbered about 10,000,000 units. Also, 1375 locomotives and 35,300 freight cars were built. All of these items showed a substantial increase over the 1933 production.

Orders placed by the Soviet Republics in Great Britain during the first eleven months of 1934 amounted to $46,000,000, more than double the amount for the corresponding period in 1933. Of this, machinery and equipment accounted for $6,500,000, as compared with only $1,800,000 for the same period in 1933.

Purchases by the Amtorg Trading Corporation in the United States for the first eleven months of 1934 amounted to $10,595,000, which was more than double the purchases during the corresponding period of 1933. Automotive and aviation equipment accounted for about 48 per cent of the total, and industrial equipment for over 25 per cent.

* * *

The British synthetic plastic industry as a whole, while of very recent origin, is one of the busiest in that country. More and more articles molded from synthetic plastics are being used in almost every branch of industry and in the building field. Hitherto laminated synthetic plastics have not been used to any great extent in Great Britain; but recently a plant capable of producing large panels and laminated sheets has been erected by a Lancashire firm that formerly supplied such laminated plastic sheets in small dimensions only.

What a Shop Executive Should Know About the Heat-Treatment of Cutting Tools

A Review of the Important Factors that Influence the Selection of Heat-Treating Methods—Second of Two Articles

By ROBERT C. DEALE
Executive Secretary, Sub-Committee on Metal Cutting Data, American Society of Mechanical Engineers

THE first installment of this article, in the February number of MACHINERY, dealt with the influence of shape and size of tools, and with furnaces for heat-treating cutting tools, covering, especially the characteristics of box type furnaces and the advantages and limitations of pot type furnaces. The present installment will discuss the controlling of furnace atmospheres, preheating temperatures, heating to the hardening temperature, standardizing heating periods, and the tempering of high-speed steel tools.

Controlling the Furnace Atmosphere

The furnace atmosphere should be as inert chemically as possible. When a truly inert atmosphere is used, not only is the scaling of the surface prevented, but the enlargement of the grain size is retarded, so that the heat-treatment that will give the best cutting efficiency can be adopted without having to make compromises in order to protect the surface of the tool.

There are four different methods of controlling the atmosphere of a box type furnace. The first, and most common, consists in varying the relative proportions of fuel and air supplied, so that the flame is more or less oxidizing. It is very difficult to control the atmosphere accurately in this manner and still maintain a predetermined temperature. As a result, it is customary, with furnaces so operated, to run at temperatures somewhat below those that give maximum cutting efficiency, in order to prevent surface scaling and grain growth.

Experimental data are available which indicate that both grain growth and scaling are greatly reduced when the atmosphere is accurately controlled at a point that appears to give a chemically inert composition. When more oxidizing atmospheres are used, there is a tendency toward scaling and grain growth, while reducing atmospheres tend to cause a surface decarburization or soft skin. The effect of this change in atmosphere has not been fully investigated, but it appears as though the point of incipient fusion of the tool is actually raised materially by going from an oxidizing atmosphere to one in which the CO content is approximately from 6 to 10 per cent, with no free oxygen.

A second method of controlling furnace atmosphere consists in supplying a furnace atmosphere of some inert gas. The difficulty in the use of this method is the great chemical activity of the various available gases at the temperatures involved. First, consider nitrogen. Nitrogen, which is inert at ordinary temperatures, has a tendency to form nitrides, which may cause brittleness. Argon, helium, and the other inert gases are rather expensive. Hydrogen has been used, but requires very careful handling to prevent it from becoming dangerous. At the present time, it is not known whether any gas is being used commercially in just this way. It is believed that this practice is confined to laboratory use.

Other Methods of Furnace Atmosphere Control

A third method of atmosphere control consists in the use of a carbonaceous material in the furnace chamber, preferably contained in a metallic holder, which tends to concentrate an atmosphere of carbon monoxide around the tool rather than to maintain such an atmosphere in the entire furnace chamber. This method, which is applicable to both electric and fuel-fired furnaces, appears to be quite effective and to give satisfactory results.

The fourth method, which has only come into use within the last seven years, controls the furnace atmosphere through a supplementary gas flame, preferably burning CO. Any hydrogen in the gas supplied to this burner would tend to form water vapor, which would cause scaling of the surface. The furnace chamber proper is heated by radiation only, using either electric or fuel sources of heat, while the supplementary flame, usually placed at the furnace door, is carefully calibrated, so that any desired combination of carbon monoxide, carbon dioxide, and free oxygen can be obtained by varying the pressure of the gas and air supplied to the burner. By placing this burner at the entrance to the furnace, free oxygen is prevented from entering, unless it is desired as a constituent of the atmosphere. At least three of the leading manufacturers of furnaces are now using this method of control, which may be considered as a good argument in its favor.

Preheating Temperatures

As the preheat chamber is used solely to bring a tool slowly to the maximum hardening temperature, the exact temperature used is not particularly important, although it should be as high as possible, under the critical point, so as to reduce the time necessary in the hardening furnace to bring the tool to full hardening heat. The usual practice is to use a temperature of approximately 1600 degrees F., although it is sometimes desirable in the case of large tools to use an additional furnace at approximately 1000 degrees F.

Tools are frequently warmed before they are put in the preheat furnace by placing them either on the fore hearth or on top of the furnace. Often, furnaces built for hardening high-speed steel have a preheat furnace above the hardening furnace in order to make use of the waste heat from the hardening chamber. High-speed steel has such poor heat conductivity that it is very desirable not to attempt to heat a tool too rapidly. Large and intricate tools are occasionally put in a furnace appreciably below the desired temperature and brought up to temperature with the furnace.

The time in the preheat chamber should be sufficient to insure that the tool is heated throughout to furnace temperature. Any additional soaking not only does not serve any useful purpose, but increases both scaling and grain growth.

Heating to the Hardening Temperature

There appear to be two different practices in hardening. The first, which does not seem to be used to any great extent at the present time, consists of a very rapid heating in a furnace held at a temperature appreciably higher than that to which the tool is to be heated. At the proper time, determined either visually or by the expiration of a predetermined time, depending on the tool size, the tool is removed and quenched.

This method appears to be rather difficult to control, as it is always hard to determine when the tool should be quenched. As the tool temperature is changing rapidly at the time of its removal from the furnace, it is particularly subject to error in case of some change in conditions or if the time in the furnace has not been very accurately controlled. This method gives a smaller grain growth for a given tool temperature and furnace atmosphere than other methods, since the tool is kept in the furnace a much shorter time than is necessary when it is brought up to full furnace temperature.

The usual practice at present is to maintain the furnace at the desired temperature and to leave the tool in the furnace until it reaches this temperature. Usually a pyrometer is used to measure this temperature quite accurately, while automatic controls are available which should always be used where accuracy is essential. These maintain the furnace temperature at a predetermined point, with an error of only from 10 to 15 degees F.

Determining when the Hardening Temperature has been Reached

The most generally used method of determining when a tool has been left a sufficient time at the hardening temperature is to watch for "sweat" to appear on the surface of the tool. Study of all available information seems to indicate that this method is most unreliable. The "sweat" seems to consist of molten scale, probably a simple iron oxide. It is believed that the appearance of this sweat may possibly indicate with some degree of accuracy the temperature reached by the surface of the tool, but it obviously gives no indication of interior temperatures.

As it is desirable, in most instances, to harden a tool an appreciable distance below the surface, so that successive grindings do not uncover progressively softer cutting surfaces, it is essential that the tool reach full hardening temperature to a depth at least somewhat greater than the amount that will be removed by grinding. The common use of this method of determining the proper hardening period probably accounts for the generally held opinion that tools lose in cutting efficiency with succeeding grinds. It is believed that this loss in efficiency is not necessary if the hardening has been properly carried out.

The leading manufacturers of small tools appear to allow a tool to remain in the hardening furnace for a short, predetermined time after it seems to be at furnace temperature. With the highly skilled heat-treaters employed by such companies, this method is undoubtedly very successful, although it is doubtful whether it can be satisfactorily used in the average machine shop or by the commercial heat-treater.

Standardizing Heating Periods

When the size of the tool is such, relative to the capacity of the furnace, that placing a preheated tool in the furnace does not cause appreciable change in the furnace temperature, it is believed that a table may be set up of the time which a tool of any size should be left in the furnace to insure that it be heated throughout. It is understood that such a method is in use by the manufacturers of twist drills. At present, the only available information on which to base such a table is that based on the experiments of French, Strauss, and Digges, at the U. S. Bureau of Standards ("Effect of Heat-Treatment on Lathe Tool Performance, and Some Other Properties of High-Speed Steel," *Trans. A.S.S.T.* September, 1923). Working with 1/4- by 1/2-inch tools, these experimenters found that cutting efficiencies increased with the time in the hardening furnace up to 1 1/2 minutes.

Unfortunately, the tests stopped at that point, so that it is not known whether 1 1/2 minutes gives maximum cutting efficiency or whether an increase in time would have improved the tool. Also, it is not known in just what way the time is connected

with the tool size, although it is believed that the time should be approximately proportional to the desired depth of penetration.

In a recent set of experiments, in which tools of identical material, size, and contour were hardened to two entirely different specifications—one being based on the previous practice of the company in question and the other on available experimental data—it was found possible to increase tool life, under identical conditions of material cut, depth of cut, feed, and speed, from fifteen to eighteen times when cutting a standard grade of gray cast iron. This was done by increasing both times and temperatures over those previously used. The grain structure was quite coarse at these increased temperatures, but this seemed to be immaterial in view of the improvement in cutting conditions. Both sets of tools were hardened in a box type furnace, fuel-fired, in which the only possibility of controlling atmosphere lay in varying the relative proportions of fuel and air.

A third set of tools, of identical composition with the first two, has recently been hardened under conditions of controlled atmosphere. These tools, which were hardened under the same temperature-time specification as used for the second set of tools, show little evidence of grain growth. These tools have not yet been given a cutting test. The cutting comparison between these tools and those hardened at the same temperatures but without control of the furnace atmosphere should be of particular interest.

Hardening Temperatures Require Further Investigation

The available data as to the hardening temperature that should be used are very incomplete. Such as are available seem to indicate that tools made of 18-4-1 steel should be hardened at 2450 degrees F., while 2400 degrees F. should be used for tools made of 14-4-2 steel. When 5 per cent or more cobalt is added, temperatures at least 50 degrees F. higher are necessary to develop the maximum cutting efficiency of the tool. Because the furnaces in general use do not provide adequately for the maintenance of the furnace atmosphere in a chemically inert condition, it is usual to use appreciably lower temperatures in order to prevent scaling and grain growth.

When temperatures, times, and atmosphere are rigidly controlled, it is believed that temperatures about 25 to 50 degrees F. lower than those given should be used, in order to allow for slight errors in the calibration and placing of thermo-couples and to secure uniformly good commercial results. Tools that are formed before hardening, such as taps, dies, and milling cutters, are usually hardened at somewhat lower temperatures than lathe and planer tools to avoid injury to the cutting edges. Particular care must be taken in hardening the cobalt and high-vanadium steels, because of the tendency to decarburize the surface and thus form a soft skin, which must be removed before the tool will cut properly.

High-speed steel tools are usually quenched in oil. When a tool is intricate and there is danger of cracking it in quenching, it is frequently quenched in molten lead at approximately 1200 degrees F. In this way, the tool is brought rapidly below the critical point, but the drop to room temperature is taken in two steps. The tool may be quenched in oil from the 1200-degree temperature, or it may be allowed to cool in the air. Such tools may also be quenched in hot water, which gives a much less severe quench than oil. The severity of the quench drops rapidly as the temperature of the water is increased.

The Tempering of High-Speed Steel Tools

While it is generally considered that the second heat-treatment, usually called "tempering," corresponds to the tempering of carbon steels, the evidence seems to indicate that this is not the case. A metallurgical change seems to occur which makes the "red hardness" of the tool actually greater after "tempering" at 1100 degrees F. for two to four hours than it was before hardening. This "tempering" temperature should be approximately 1100 degrees F. for the 18-4-1 steels; 1050 degrees F. for the 14-4-2 steels; 1150 degrees F. for the 18-4-1 steels with cobalt; and 1150 degrees F. for the 14-4-2 steels with cobalt, when maximum cutting efficiency is desired. Because of the sluggishness of the metallurgical reaction, it is desirable to hold the tools at the above mentioned temperatures from 2 to 4 hours, to insure that the necessary transformations have taken place.

When maximum strength against shock is required, it is believed that "tempering" temperatures from 900 to 1000 degrees F. should be used. The data as to this point are not clear, and it is not certain whether the foregoing treatment will give the desired results or not.

All available data on the heat-treatment of high-speed steel tools seem to be in a rather unsatisfactory state, as there are few sets of experiments in which the method of heat-treatment is accurately tied in with the cutting efficiency of the tools so treated. The Sub-Committee on Metal Cutting Data of the American Society of Mechanical Engineers is working on this point, and hopes to be able to present authoritative data within one or two years. A tremendous amount of work will be necessary before it will be possible to determine the effect of all possible changes in the method of heat-treatment on the permissible cutting speed. The data on the cutting of metals have not been so definite as is desirable, with the result that it may well be considered an art, rather than a true branch of engineering. In time it is believed that all data on the hardening of tools may be reduced to a point where the effect of any given change in heat-treatment may be accurately predicted.

Sound Die-Castings of Aluminum Bronze Produced by the Use of Vacuum

Liquid Metal at Temperatures Above 2000 Degrees F. is Drawn by Vacuum into Dies to Form Castings of Unusual Strength

By CHARLES O. HERB

DIE-CASTINGS having a tensile strength of 85,000 pounds per square inch, as cast, and a hardness of 140 Brinell are produced by the Aurora Metal Co., Inc., Aurora, Ill., in a large variety of shapes. By reheating the castings to 1700 degrees F. and quenching them in water, their tensile strength can be increased to as much as 100,000 pounds per square inch and their hardness to 260 Brinell! Even at elevated temperatures, these castings maintain their tensile strength to an unusual degree; at 1000 degrees F. it is as high as 19,000 pounds per square inch.

These castings are generally made from an alloy composed of 89 per cent copper, 10 per cent aluminum, and 1 per cent iron. The composition can, however, be varied slightly to obtain physical characteristics that will adapt the castings to special requirements. In addition to the advantages of high strength and unusual hardness, these aluminum-bronze die-castings offer effective resistance to abrasion and high resistance to corrosion under many adverse conditions.

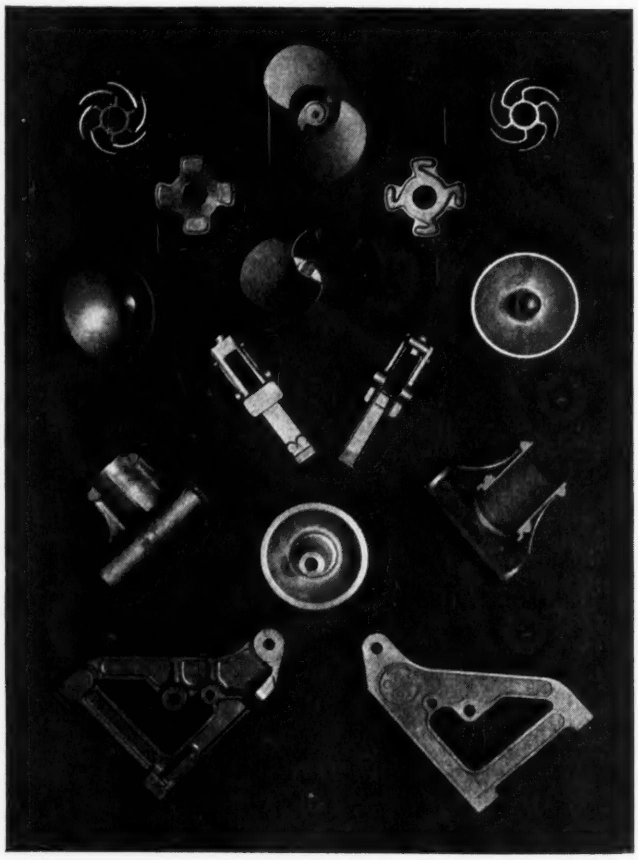


Fig. 1. Die-castings of Aluminum Bronze Made by a Process in which the Molten Metal is Drawn into the Die by Vacuum

A distinctive feature of the process employed by the Aurora Metal Co., Inc., for the production of aluminum-bronze die-castings, is the use of vacuum for drawing or sucking the molten metal into the dies. The principle is exactly the reverse of the one followed in the design of conventional die-casting machines, namely, that of applying pressure to force the metal into the dies. In the patented process used by this concern, the steel die-casting die is swung into position over the pot of the melting furnace by means of an air hoist and lowered until a gate at the bottom of the die has been immersed several inches into the molten metal. Then a valve is automatically opened to connect a vacuum line to the die. Thus, all the air is drawn from the upper end of the die and the molten aluminum bronze is sucked in through the gate at the bottom. With the gate beneath the surface of the molten metal, none of the impurities in the dross at the top of the pot can enter the die.

There is a steady flow of the molten metal to all points in the die cavity until it has been completely filled. After the casting has solidified to some extent, the vacuum line is disconnected, the die is raised and swung away from the melting pot, and finally the die is opened to remove the casting. Castings weighing as much as 30 pounds have been produced by this method.

Vacuum for this die-casting process is created by means of a rotary pump. The degree of vacuum required depends upon the height of the die cavity and the design of the part being cast, that is, whether it is simple or complicated. There must be sufficient vacuum to insure that the stream of metal entering the die will flow unbroken to all parts of the cavity. Perfect vacuum is considered obtained at a reading of about 30 inches of mercury. In this process, the vacuum readings range from 5 to 25 inches.

Fig. 2. Pump Impeller of Silicon Bronze Produced in a Die through the Use of a Sand Core

Aluminum bronze has a melting point around 1950 degrees F., but in the die-casting process used by this concern, it is cast at temperatures ranging between 2050 and 2300 degrees F. The actual casting temperature depends mainly upon the design of the piece being cast. Thin sections with a small sprue hole require a higher casting temperature than thicker castings with a larger sprue.

With such high casting temperatures, the alloy steel dies used naturally do not have so long a life as when die-castings from zinc, aluminum, or magnesium alloys are produced. Nevertheless, they last long enough to effect real economies when such factors are considered as the quality of the castings, the reduced machining necessary, and the lessened first weight of the castings, as compared with sand castings. Another important advantage lies in the fact that casting rejections are practically negligible with this process, and when they do occur, there is no loss in material, because the scrap can be thrown directly back into the melting pot and used again.

The outer surfaces of the die-casting naturally solidify before the inner portions, because the outer metal is in contact with the cooler surfaces of the die. It is important, therefore, to so design the dies that the thin sections of the castings do not solidify before sufficient molten metal has reached all parts of the die cavity. This point must be carefully observed, in order to insure castings that are solid throughout.

One or more pockets are always provided at the top of the die cavity to form risers on the die-casting, and it is important that the metal in these risers be kept liquid until the last. Sometimes it is necessary to place a thin sheet of asbestos around the wall of these pockets to prevent the metal of the risers from coming in contact with the die surfaces and freezing before the die cavity has been completely filled.

With the metal of the risers remaining liquid until the last, this excess metal can flow back into the die cavity to compensate for the shrinkage that occurs during the solidifying of the casting. Shrinkage is therefore completely confined to the risers and solid castings are the result. The risers and the sprue are cut off when the casting has cooled, and they are remelted, so that there is no waste of material.

The castings produced by this method are without blow-holes because the air is withdrawn from the die cavity, and air cannot enter the gate, due to its immersion in the pot of molten metal. Another important advantage derived from making aluminum-bronze castings in dies is that inclusion of aluminum oxide does not occur in the body metal. This has been one of the most difficult problems in casting aluminum bronze by other methods. However, in the vacuum die-casting method,

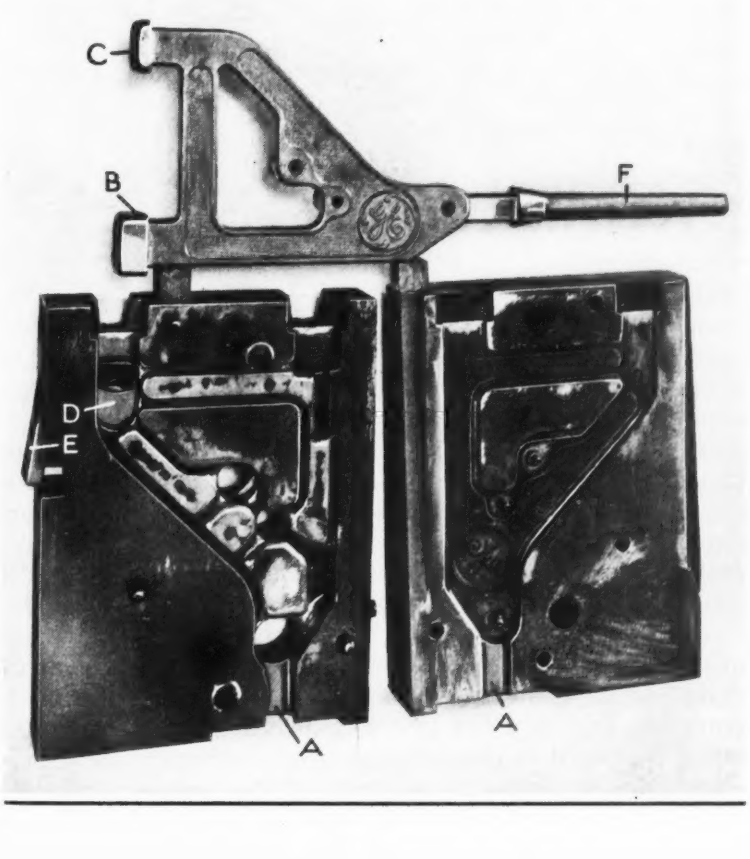


Fig. 3. Die Used in Producing an Aluminum-bronze Bracket Having a Tensile Strength of 85,000 Pounds per Square Inch

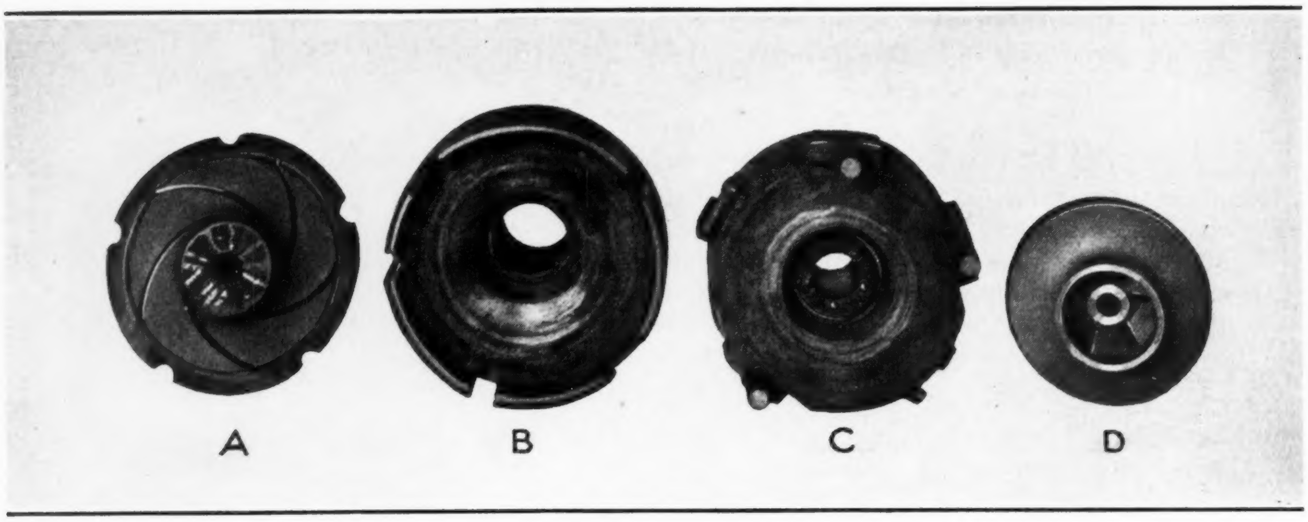


Fig. 4. The Die and Sand Core which Produce Pump Impellers of the Type Shown at D

the small amount of aluminum oxide that is formed on the advancing level of the metal in the die is deposited in a thin film on the walls of the die cavity, and therefore is on the outer surfaces of the die-casting, where it can do no harm.

Tolerances equal to about 1/2 of 1 per cent can be easily maintained in most instances on the diameter or straightness of holes, the center distance between holes, and similar dimensions. Thus, for instance, if the diameter of a hole was 0.824 inch, the hole could easily be cored with a total tolerance of 0.0041 inch. Closer tolerances can be maintained, but the cost of the castings increases considerably when extreme accuracy is required.

Uses of Typical Aluminum-Bronze Die-Castings

Aluminum-bronze die-castings of quite a range are shown on the display board in Fig. 1. In the center at the top of this board is shown an impeller used in an electric dish-washing machine. This impeller measures about 7 inches in maximum diameter and is characterized by long curved blades of unusually thin cross-section, the minimum thickness of the blades being only 3/64 inch. These impellers are die-cast with such a smooth finish and accuracy that only a minimum amount of machining is necessary to prepare them for assembly.

On each side of the impeller are shown centrifugal pump rotors, also used in a dish-washing machine. While light in weight, these rotors have plenty of strength for their purpose and do not wear or corrode. Other examples on the display board are used in applications where strength is important, in combination with resistance to corrosion or abrasion. Spur gears for hydraulic pumps and other applications, as well as gear segments and worms, are cast with ease from aluminum bronze, and they can generally be used without any machining on the teeth.

On all die-castings made by this process, surfaces that must be machined can be provided with a minimum amount of excess stock, in comparison with sand castings. This is a factor of considerable importance, as it reduces the cast weight of the part. For example, die-cast gear blanks sometimes weigh as much as 30 per cent less than sand cast blanks. Consequently, while the cost per pound is higher for the aluminum-bronze die-casting than for the sand casting, the total cost may be less, because of its reduced weight.

At the bottom of Fig. 1 are shown two brackets that have over-all dimensions of 10 by 7 5/8 inches. These castings weigh about 6 pounds apiece. Fig. 3 shows the die used in producing this part. The sprue hole *A* at the bottom of each die half is about 1 inch square, while the pockets at the top that form the risers *B* and *C* are about 2 inches square.

An interesting feature of this die is the swinging core *D*, which forms a slot in the bracket. This core is swung out of the casting by means of lever *E* to permit the casting to be taken from the die. At *F* is seen the long bar of excess stock that is formed in the gate which is fastened to the bottom of the die.

Sand Cores Can be Used in Making These Die-Castings

Pieces of fairly complicated design can be made by the vacuum die-casting process through the use of sand cores, thus avoiding the necessity of employing moving cores in the dies. This feature of the process also permits the casting of many pieces that could not be made with moving cores as, for example, the pump impeller which is shown in Fig. 2 partly cut away to illustrate the curvature of its vanes.

This impeller is 5 1/2 inches in diameter. The die used in producing it is of comparatively simple design, being made up of the two halves shown at

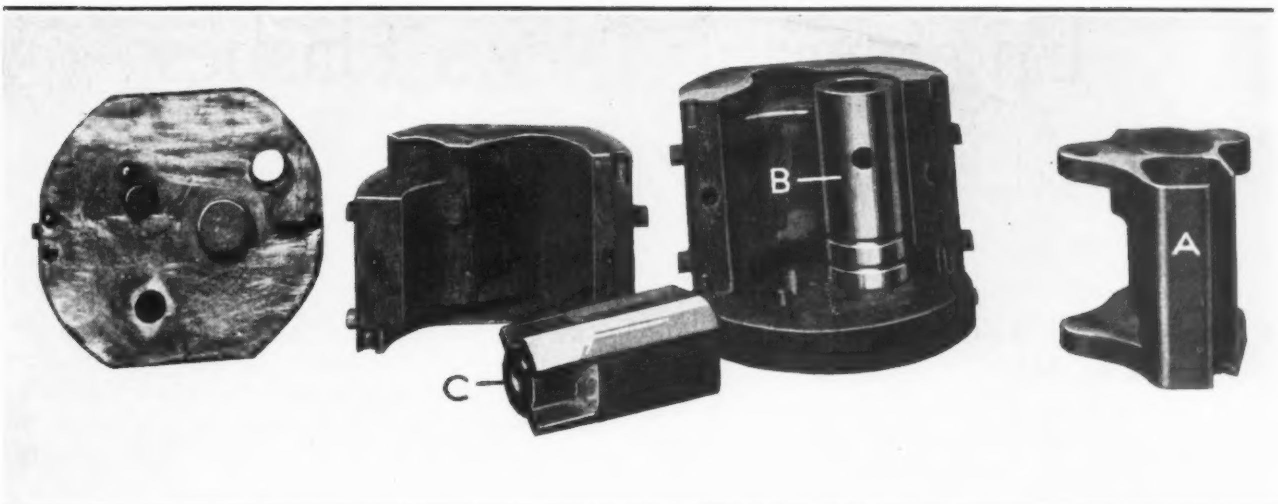


Fig. 5. Die for Producing a Part with a Bronze Sleeve Cast in Place for Use as a Bearing

B and *C* in Fig. 4. At *A* is the sand core that produces the vanes between the two flanges of the piece, and at *D* is the impeller casting as it comes from the die.

The sand is removed from castings of this type either by ordinary means or by sand-blasting. These impellers are cast from a patented silicon bronze consisting of 81 per cent copper, 14 per cent zinc, and 5 per cent silicon. This alloy melts at about 1800 degrees F., but the furnace must be held at a temperature of about 2100 degrees F. to insure that the metal will flow readily into the slots of the sand core which form the vanes.

Castings that Require Inserts of Different Metals

In this die-casting process, the aluminum bronze can be readily cast around pieces of other metals that are placed in the die in the form of inserts. Thus, for example, castings can be produced that are attached to steel shafts. At *A* in Fig. 5 is shown an aluminum-bronze die-casting with a bronze bushing or sleeve that is cast in place. To the left of part *A* are shown the various members of the die used in producing it. The bronze insert is positioned in the die as shown at *B*, and the steel core *C* is positioned vertically on the pins of the die adjacent to the insert. This is done before the second half of the die and the top at the extreme left are assembled.

The bronze insert used for this part has a lower melting point than the aluminum bronze from which the part is made, but in the casting operation, the aluminum bronze freezes immediately when it reaches the insert and thus enables successful results to be obtained. The two holes seen in the die top permit the formation of the risers to eliminate the shrinkage that occurs in cooling. One of the bosses in the die top centers the insert and two others locate the loose core. The casting made in this die has an over-all length of 4 3/4 inches.

When dies are to be used for the limited production of a part, their cost can generally be reduced correspondingly. For example, there is a manufacturer who requires only ten small eccentric spur gears of a certain type each year. He supplied a steel sample from which a die was cast of aluminum bronze. This casting was cut in two, mounted in a suitable holder, and has since been used for casting the required gears from aluminum bronze—the same material as the die itself.

Eighty gears have been cast in this die and it is still in fairly good condition. Little deterioration has occurred because of the fact that the molten aluminum bronze freezes immediately when it strikes the die surfaces.

* * *

The Cleveland Machine Tool Exposition

According to an announcement made by the National Machine Tool Builders' Association, the machine tool exposition to be held in Cleveland September 10 to 21 this year will be by far the largest exhibition of machine tools and accessory products ever held in the United States, and almost certainly the largest industrial exposition in this country during the present year.

Applications for space, it is announced, require an exhibit area more than 50 per cent greater than the total space occupied by the last machine tool exposition, held in the fall of 1929. It is expected, on the basis of applications already received from member and accessory companies, that all the available space of 250,000 square feet will be exhausted months in advance of the opening of the exposition. Applications for space have already been received from 110 member companies of the National Machine Tool Builders' Association and from 75 companies in the accessory field.

Engineering News Flashes

The World Over

Studying Wind Velocities of 500 Miles an Hour

Langley Field, Va., is to have a wind tunnel capable of resisting the tremendous forces of a gale blowing at a velocity of 500 miles an hour. The structure is to be a part of the laboratory of the National Advisory Committee for Aeronautics, and is to be 154 feet long, 51 feet wide, and 25 feet high, with a test chamber 8 feet in diameter. The reinforced-concrete walls are to be lined with steel plates. It is said that a total of 8000 horsepower will be required to simulate a wind of the desired velocity. With this tunnel, it is proposed to study the natural laws governing air flow exceeding 200 miles an hour. It has been determined through research that flying machines can make 500 miles an hour and more; but in the absence of the knowledge that is to be sought through the medium of the new wind tunnel, the present *safe* speed limit is about 200 miles an hour.

Making Oil and Gasoline from Coal

Considerable progress in producing oil and gasoline from coal is being made in Great Britain. The National Coke & Oil Co., Trafford Park, Manchester, is planning to build a factory for extracting oil from coal. A site of five acres has been set aside for the plant. The Imperial Chemical Industries at Billingham-on-Tees are just completing their coal-oil plant. Actual production will be started early in the spring. These works are planned on a huge scale. The yearly output of oil and gasoline is expected to be 300,000,000 gallons. Two plants for extracting oil from coal are also being planned in Scotland.

Huge Soviet Machinery Plant Completed

The giant Soviet plant of Kramatorsk for the production of heavy machinery and equipment, the building of which was commenced in October, 1929, has been completed and was officially opened recently. The first unit of the plant was completed in November, 1933. When the Kramatorsk plant is working at full capacity, it will be capable of producing annually 6 completely equipped blast furnaces, 30 completely equipped open-hearth furnaces, 3 blooming mills, 16 rolling mills, 20,000 tons of crane capacity, 16 gas generators, and equipment for coke ovens, the chemical industry, and power plants. It will employ over 23,000 people. At present, about 15,000 people are employed at the plant.

Largest Diameter Gear Cut in Canada

A gear believed to be the largest diameter cut gear ever made in Canada was recently produced by the Hamilton Gear & Machine Co., Toronto, Ont. The outside diameter of this gear is approximately 17 1/2 feet, the gear having 328 teeth of 2-inch circular pitch. The face of the gear is 6 inches. The gear is built up from eight sections, each section being made from welded rolled steel. The gear teeth were cut on a hobbing machine. The gear is to be used for a tumbling barrel for washing sugar beets in the Canada & Dominion Sugar Co.'s refinery.

Heating a Building with Cold Water

Reversible air conditioning equipment, which may be adapted to either heating or cooling, depending on the season, is now in operation in the new building of the Atlantic City Electric Co. at Salem, N. J. Engineers of the General Electric Co. and of the American Gas and Electric Co. installed the equipment, which is of the reversible-cycle refrigerating type, commonly known to engineers as a "heat-pump." Reversing the cycle of the ordinary household refrigerator, electrically driven compressors absorb heat from a low-temperature source, raise it to a higher level of temperature by mechanical compression of the refrigerant gas, and discharge it at high enough temperature to heat the building in cold weather. In summer, the process is reversed. Both heat and moisture are withdrawn from the air of the building, and the heat is raised by the compressor to a high enough temperature level to be dissipated outside.

The heat is drawn from a well of water which maintains a natural temperature of at least 56 degrees F. in the coldest weather. Hence the equipment is able to deliver its maximum capacity without regard to outdoor weather conditions. The heat

is transferred from the water to the refrigerant in a large water cooler, the water leaving the cooler at about 40 degrees F. In the compression cycle, the temperature of the refrigerant is raised to 135 degrees F. and gives up its heat to the air within the building by passing through a condenser over which the air is circulating.

In summer, this condenser will act as a cooling surface to cool and dehumidify the air, and the heat thus absorbed will be dissipated by the water cooler, which may then serve as a water heater. Humidifiers for winter use, air filters, and a high-velocity fan and air circulating system complete the air conditioning apparatus, maintaining close automatic control of both temperature and humidity within the building summer and winter.

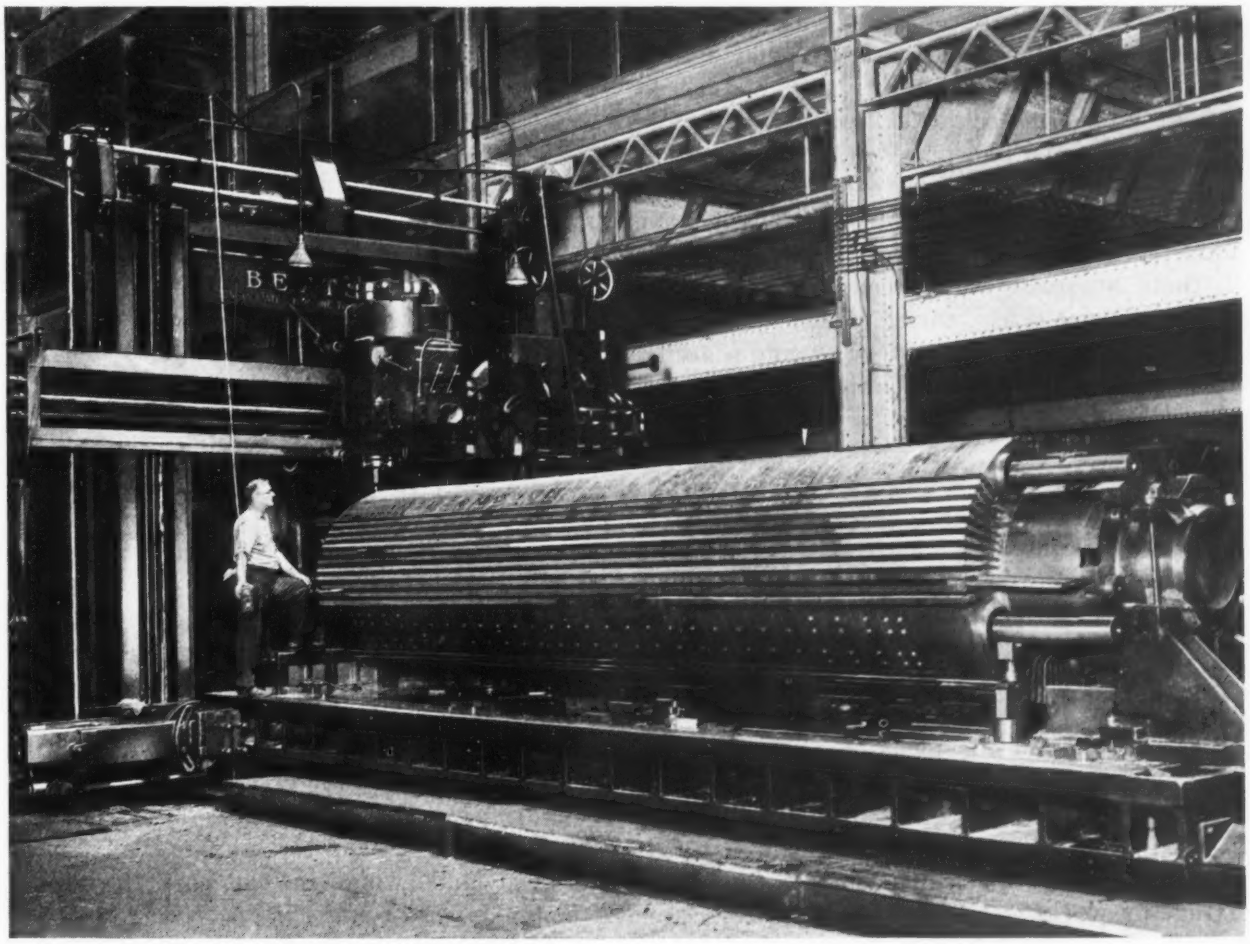
World Record for Distance Flying

The Soviet Republics now claim the world's record for long-distance flying. A new plane of Soviet construction, equipped with a Soviet-made engine, took off from the Moscow Airdrome with three pilots aboard and maintained itself in the air for seventy-five hours, covering in that time a distance of approximately 8000 miles without refueling.

Density of Rail Traffic Greatest in Britain

According to the latest available statistics for the world's railways, as quoted in *Industrial Britain*, the railways of Great Britain run nearly twice as many trains per mile of track as the railways of Germany, more than twice as many as the French railways, and five times as many as the railways of the United States. It should be noted, however, that the comparison is made on the basis of number of trains. Had the tonnage, especially of freight trains, been taken into account, it is likely that the density of traffic on the railways of the United States would have appeared greater than here shown; because nowhere are the freight cars regularly used of the capacity employed here, nor are freight trains of such length as here.

The Rotor for the World's Most Powerful Single-shaft Generating Set, Rated at 183,333 KVA. The Wedge Slots are Being Milled on a Betts Planer in the Shops of the Westinghouse Electric & Mfg. Co. The Rotor is 26 Feet Long, Made Up of 60-inch Diameter Disks and End Forgings, Held Together by Four 6-inch Bolts and a 13-inch Nickel-molybdenum Steel Center-bolt Weighing 6 Tons. The Total Weight of this Generator Set Rotor is in the Neighborhood of 250,000 Pounds.



EDITORIAL COMMENT

Skilled Machinists May be Scarce as Business Revives

Notwithstanding the prevailing unemployment, several machine tool builders tell us that it is becoming increasingly difficult to find good machinists and toolmakers in some of the machinery centers. By far the largest proportion of the unemployed are the unskilled or half-skilled; and many who pass themselves off as machinists and toolmakers are not able to fill a well trained man's job.

As soon as there is an appreciable revival in the machinery industries, this lack of skilled machinists will make itself felt. One of the well-known machine tool builders has already started a training course with a view to providing skilled men for his plant. Others hope that some of the mechanics who have drifted away from the machinery industry during the depression may return to it, which, of course, will be true in many cases; but there are numerous instances where these men have obtained jobs in other occupations, in which they will probably continue.

To what extent the lack of skilled men will have an effect on machine tool prices when the demand for machine tools rises to more normal levels is difficult to predict; but some of those engaged in the industry feel that if there is a revival in demand, there are many conditions that will make for increased price levels, among which the restrictions placed on industry, higher taxes, and scarcity of skilled mechanics may be counted as important factors.

Work, and Work Only, Wisely Directed, Can Bring Recovery

It is difficult to understand the tenacity with which man holds on to an erroneous idea. History records many instances where erroneous ideas have made men and nations pursue courses that have led them into serious difficulties and sometimes to national disaster.

One of these erroneous ideas that is currently accepted by so large a number of men holding positions of leadership in government and labor organizations as to seriously threaten the well being and comfort of the American people, is the queer belief that by working *less* there will be *more* for everybody. By reducing the number of hours of work, the people of the country are supposed to become better off. By producing less of what they need and want, they will have a greater abundance.

To try to convince those capable of such logic of the fundamental error in their ideas is, as a rule, useless. Most men like to jump at conclusions rather than arrive at them by clear thinking. Nevertheless, it is of importance to those who are unwilling to accept ideas as true, simply because they are held by the majority, to have the facts restated from time to time.

In the *Link-Belt News*, George P. Torrence, president of the Link-Belt Co., concisely states the facts as follows: "As an emergency, spreading work by reducing hours may be justified, but it should be understood that every step taken to reduce the output of individuals means a corresponding reduction in what each can buy with a week's work. Every reduction of output is a move to reduce the scale of living, since fewer things are made.

"Unwittingly perhaps, but none the less certainly, the proponents of a thirty-hour week are advocating the reduction of the scale of living for everybody. Obviously a man cannot produce in thirty hours what he can produce in forty hours. Improvement in material well being depends on increasing production in a week, so that more can be bought with a week's work. Recovery and improved living—'the good life' of the President—will come only with increased production."

We cannot solve our unemployment problem by working less. It can be solved only by encouraging industrial activity; and this, in turn, means that the obstacles that hamper industrial activity must be removed.

▼ ▼ ▼

Experience teaches us that the existence of large credit resources can do little for a country unless there are correspondingly large opportunities for their profitable use. These opportunities are notoriously lacking, thanks to a taxation system which has been made worse instead of better.—*Stephen Bell in Commerce and Finance*

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Combination Link, Gear, and Cam Mechanism for Oscillating Bellcrank

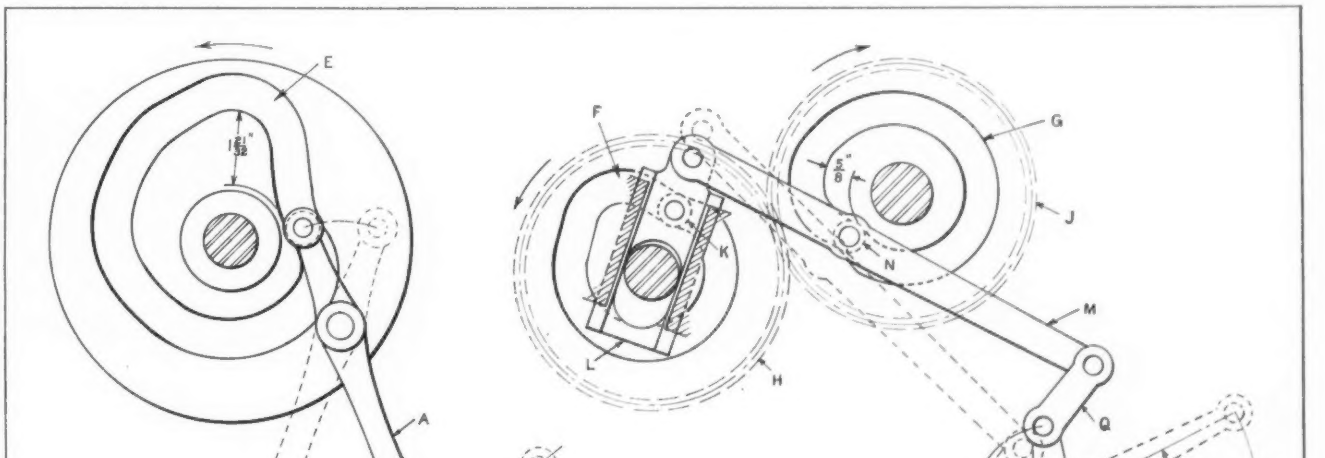
By PAUL GRODZINSKI

The possibilities of mechanisms consisting of links, gears, and cams for imparting oscillating movements to bellcranks are indicated by the accompanying illustrations. These mechanisms are incorporated in a shoe-sewing machine built by the firm of Adrian & Busch, Oberursel, Germany. The first design, shown in the view to the left, consists of a simple cam drive. The motion of the swinging member *A* is transmitted by means of a rod *B* to the bellcrank *C*, which is required to oscillate or swing back and forth through an angle of approximately 80 degrees about the center of shaft *D*.

To obtain this movement, the driving cam *E* must have a rise of about 1 21/32 inches. The quick rise in the cam groove required to meet this condition, however, prevented the mechanism from being satisfactory for this particular application. An enlargement of the base diameter of the cam disk or a change in the distance between the fulcrum of the lever and the cam axis to overcome this difficulty was impractical.

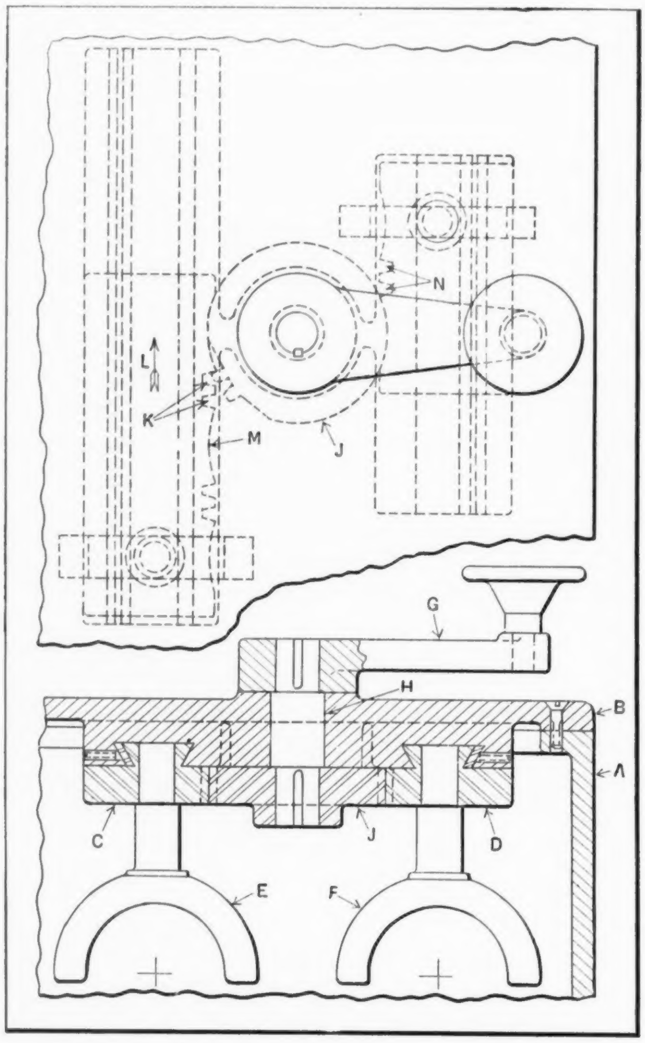
For this reason, the improved mechanism shown in the view to the right was designed. In the latter mechanism, an additional motion is imparted to the swinging lever by the use of another cam. The two cams *F* and *G* are driven in opposite directions by spur gears *H* and *J*, which are of equal size. These gears revolve on the same axis as the cams that they drive. Cam *F* actuates roller *K* attached to the slide *L*, which is mounted between guides on the cam-plate. The lever *M* is attached to the slide *L* and receives an additional motion from the cam disk *G* through the roller *N*.

The motion of bellcrank lever *P* is derived from lever *M* through rod *Q*. As shown in the illustration, the stroke of lever *M* is greatly increased by the two cams *F* and *G* and the slide *L*. The rise of each cam in the new mechanism is reduced to about 5/8 inch. Thus the pressure angle between the cam



Combination Link and Cam Mechanisms Used to Impart Oscillating Movement to Bellcrank

profiles and the driven members L and M will not be too small at any position of the moving elements. The mechanism described works satisfactorily at speeds ranging from 400 to 500 revolutions of the driving gears per minute.



Gear-shifting Mechanism that Insures Easy Changing of Gears in Order of Speed Ratios

Mechanism that Insures Changing Speeds According to Successive Gear Ratios

By J. E. FENNO

An ingenious application of intermittent gears is incorporated in the mechanism shown in the accompanying illustration. This mechanism is designed for shifting change-gears axially in a metal-spinning machine. Provision is made for obtaining three different speeds and for shifting the gears into the neutral position in the order of their ascending and descending ratios. Only one hand-lever is employed for manipulating the gears. The speeds are arranged in geometric progression and the provision for changing them in accordance with their ratios was made to avoid clashing of the gear teeth when changing speeds while the machine is in operation. With this arrangement, the pitch-line velocities of the gears to be engaged are so nearly the same that the teeth slide readily into mesh.

The gear-box is indicated at A and its cover at B. On the cover is mounted the entire gear-shifting mechanism, which consists essentially of the two slides C and D to which are attached the gear-shifting forks E and F; the hand-lever G keyed to shaft H; and the intermittent gear J, which is keyed to the shaft and engages the slides C and D.

With the hand-lever in the position shown, the change-gears (not shown) are in neutral. By rotating this lever in a clockwise direction, the two teeth in pinion J engage the tooth spaces K in slide C, causing the latter to move in the direction of arrow L. The movement of slide C continues until fork E slides the corresponding change-gear into mesh for imparting the lowest speed to the machine spindle. At this point, the cylindrical part of the pinion engages the corresponding depression M in the slide, locking slide C in a stationary position. To obtain the next higher spindle speed, the rotary movement of the lever is continued until the teeth in gear J engage the tooth spaces N in slide D. Up to this point, this slide has been locked in a stationary position by the cylindrical part of the pinion J.

As the lever continues to rotate, slide D is moved in a direction opposite that indicated by arrow L, causing the fork F to shift another gear into mesh and thus obtain the second speed. The next two speeds are obtained in like manner—that is, by continuing the rotary movement of lever G in a clockwise direction. Graduation marks on the gear-box cover and an arrow attached to the lever hub indicate the positions of the lever for the various speeds, as well as the position when the gears are in neutral.

In order to shift the gear to neutral when the lever is in the "high speed" position, the lever must be swung through an angle of approximately 450 degrees. However, owing to the successive arrangement of the gears, their action in shifting is so smooth that the lever can be shifted very rapidly between these two points. There are various other possible combinations of the mechanism shown, which permit it to be readily adapted to various types of machines in which a saving in production time could be effected if the gears could be shifted while the machine was in motion.

Varying a Reciprocating Movement at One Point of Reversal

In a certain textile machine, the member that guides the yarn as it is wound on conical bobbins is given a reciprocating movement of uniform length until several layers of yarn have been wound. Then the length of this movement is gradually diminished so that when completely wound, the

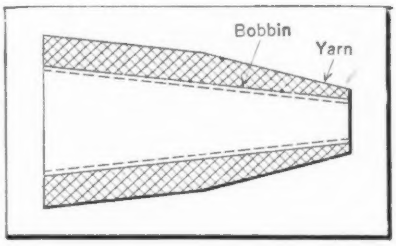


Fig. 1. In Winding this Bobbin, the Yarn is Guided by Means of the Mechanism Shown in Fig. 2

yarn on the small end of the bobbin forms a cone of greater taper than the bobbin itself, as shown in Fig. 1.

The mechanism for producing this movement is shown in Fig. 2, the member for guiding the yarn being indicated at *A*. This member slides on the stationary guide *C* and receives its motion from the reciprocating cross-head *G* through the bellcrank lever *M*, pivoted to the cross-head at *H*. The cross-head slides on stationary bars *E* and *F*, and is reciprocated by means of cam *K* on shaft *L*.

On the lower arm of lever *M* is a roll *m* which engages a channel cut in the bar *O*, pivoted at *n*. Another roll *P* at the free end of bar *O* engages the groove in the cam *Q*. This cam controls the angular position of bar *O*, and is rotated at the required speed by the worm and worm-gear *S* and *r*.

It will be noted that the path of cam *Q* is concentric with its shaft for 180 degrees. Hence, while roll *P* is passing over this part of the cam, bar *O* will remain stationary and the length of the stroke of member *A* will remain constant. This is clearly shown in the diagram, Fig. 3, where the length of the stroke at this time is indicated at S_1. It will be seen that this stroke is equal to the movement of the cross-head *G*, Fig. 2, plus the movement of the upper end of lever *M* resulting from its engagement with bar *O*. It is during the cam dwell that the first layers of yarn are wound along the length of the bobbin and parallel to its conical surface.

At the end of the dwell, however, roll *P* moves toward the center of the cam, swinging the bar *O* downward and thus changing the angular position of the lever. As a result, the stroke of member *A* is gradually diminished until the channel bar and the lower arm of the lever are in line. In this position (momentarily), the linear speed of member *A* and cross-head *G* are equal and their movement is indicated at *S* in the diagram, Fig. 3.

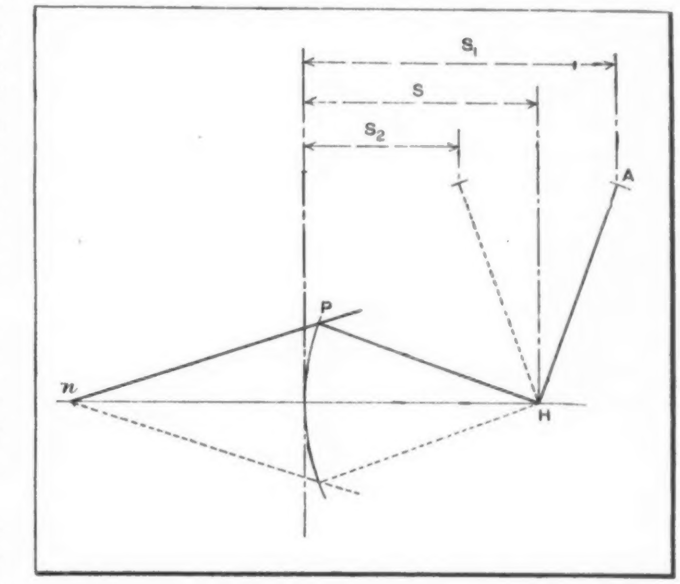


Fig. 3. Diagram Showing how the Oscillation of the Bellcrank Lever Shortens the Stroke in the Mechanism Illustrated in Fig. 2

As roll *P*, Fig. 2, continues toward the center of the cam, the stroke of member *A* decreases still more until the channel bar and lever have assumed the position indicated by the dotted lines in Fig. 3. The stroke now is equal to S_2 and at this time, the bobbin is completely wound.

Referring to the diagram Fig. 3, it will be seen that the stroke is shortened only at one end. Consequently, as each successive stroke is shortened, the length of each successive layer of yarn is decreased a corresponding amount. Hence, the wound yarn at the small end of the bobbin forms a cone having a greater taper than the bobbin itself. This increased taper depends on the contour of cam *Q* and also on the rotary speed of the cam. This type of mechanism is used in many winding machines other than textile machines. L. H. L.

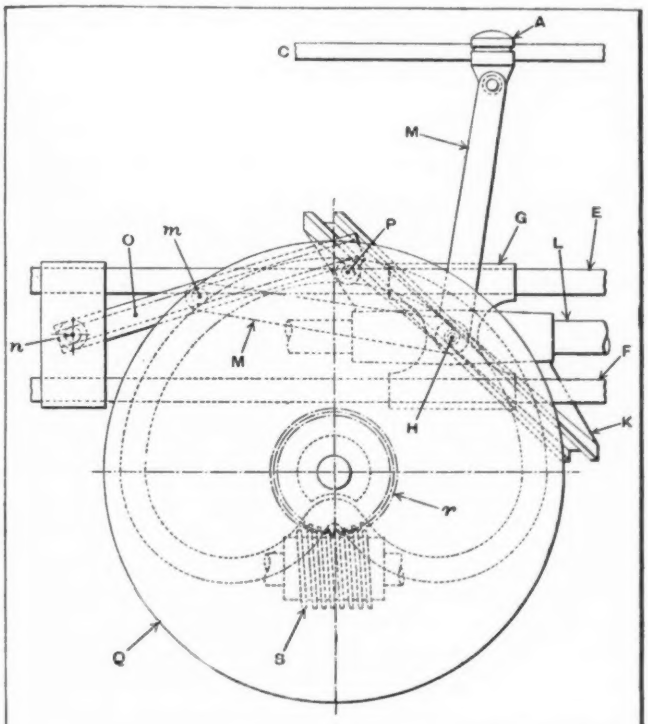


Fig. 2. Reciprocating Mechanism for Varying the Length of the Stroke of Member A which Guides the Yarn as it is Wound on the Bobbin Shown in Fig. 1

* * *

Even at engineering conventions there are some speakers that may be likened to some railroads—single track and without terminal facilities.

Seam Welding with Thyratron Control

By GEORGE H. HALL

ELECTRIC resistance welding may be generally classified as: (a) Line or seam welding; (b) spot welding; and (c) butt welding, depending upon the method employed for heating the pieces of metal in contact so that they will become fused or welded together. If the pieces to be welded are held between two electrodes and a heavy current is passed from one electrode to the other, the resistance to the current as it passes through the metal will cause the generation of sufficient heat to weld the pieces together at the point of application of the electrodes. This constitutes a spot weld. If, however, the electrodes are in the form of rollers or disks and the metal passes continuously between and in contact with them, line or seam welding is accomplished. It is the purpose of the present article to treat only of this type of welding.

Intermittent Application of Heat Gives More Uniform Welds

In seam welding, if the current is applied continuously, a relatively large amount of heat is required at the start, but as the rollers move forward the heat travels ahead of the rolls and less heat is required. In seam welding with a continuously flowing current, the current tends to follow the path of least resistance, resulting in the skipping of high spots and the production of an imperfect weld. Also, if the current is properly adjusted for a thick portion of the metal it will be too heavy for the thinner parts, and burning will result.

The remedy for these troubles is the intermittent application of heat as the work passes under the rolls or electrodes. This produces a line or seam weld which consists, in effect, of a series of overlapping spot welds. The metal chills between each spot and there is no building up of the heat as the work progresses. The current is forced through the joints for short intervals by the application of a voltage sufficiently high to break down the resistance of the parts being welded, and any tendency to skip or leave small sections unwelded is thereby avoided. This procedure has been satisfactorily developed for the welding of such materials as stainless steel, mild steel, chromium- and cadmium-plated steel, Monel metal, and aluminum.

Interrupting Current Several Hundred Times per Minute is Feature of System

In employing this method of welding, it is often necessary to interrupt the flow of current several hundred times per minute in order to obtain overlapping spots when the work is traveling at a satisfactory speed, which may be as high as 75 to 100 inches per minute, depending upon the nature and thickness of the metal being welded. Consequently, the success or failure of this type of welding depends upon the accuracy and reliability of the mechanism by which the continual interruption and restoration of the flow of current is governed.

For the attainment of this service, both mechanical and magnetic circuit-interrupting devices have been tried, but without entire success. Interruptions of heavy current on the breaking contactors pit their tips, and because of the frequency of the interruptions, they wear out rapidly, thus entailing high maintenance costs. Mechanical interruptors often require water cooling of the contacts, which means elaborate and time-consuming labor whenever contact replacement is needed, and in extreme cases this may occur after a single day's operation. As the success of this type of welding is vitally dependent upon the accuracy with which the "on" and "off" periods follow each other it has been found extremely difficult to produce a mechanical timer that will maintain its action without being subject to variations caused by wear, friction, or temperature changes. This is readily appreciated when we consider that these periods may at times be limited to one or two cycles which, on the customary frequency of sixty cycles, means a duration of one or two sixtieths of a second. Accuracy under such conditions requires that the circuit interruptions shall be synchronized with the frequency of the power supply, which is very difficult of accomplishment with a mechanical device.

Thyratrons Solve Current-Interrupting Problem

The most satisfactory method of control for seam welding has been found in the employment of the synchronous timer using electron tubes of the type known as thyratrons or ignitrons. With this timer, the "on" and "off" periods are accurately controlled in synchronism with the frequency of the current employed. The basic element of this control is a pair of thyratron tubes connected in circuit with a series transformer, which, in turn, is in series with the primary of the welding transformer. When current flows through either one of these tubes, the impedance of the primary winding of the series is very low, so that practically full load current flows through the primary of the welding transformer. When neither of the tubes is conducting, the secondary winding of the series transformer is open-circuited and the current flowing through its

primary is only the exciting current, which as far as the welding operation is concerned may be considered negligible. By suitable control of the grids, the tubes are made to conduct or cease to conduct, and in this way, the flow of the welding current is regulated.

The thyratron synchronous timer consists of a timing circuit which controls the total welding cycle, that is "on" plus "off," and a ratio control circuit which adjusts the relation between the on and off periods. The timing circuit employs one small thyratron tube which conducts at regular intervals, the length of which can be adjusted in steps of one cycle each. The ratio control employs two small tubes which can be adjusted by means of a variable resistor to give the desired relation between the on and off periods during each welding cycle.

Thus the ratio control circuit, the timing circuit, and the power circuit all operate in synchronism with the system frequency. Once adjusted, this control maintains the timing for each successive welding cycle to an exceedingly high degree of accuracy. As there are no moving parts in the power circuit, there is nothing to get out of order, so that maintenance is reduced to a minimum.

With the adjustments thus provided, the welding cycle can be varied from one cycle on and one cycle off to ninety-seven on and seven off or any combination between these limits that may be desired. The duty cycle may have a long period on and a short one off or a short one on and a long one off. This gives a range of welding speeds varying from twenty-one spots per inch to one spot in several inches, as the particular work in hand demands. Welding speeds as high as 100 inches per minute with twelve to fourteen spots per inch have been found practical on such material as stainless steel.

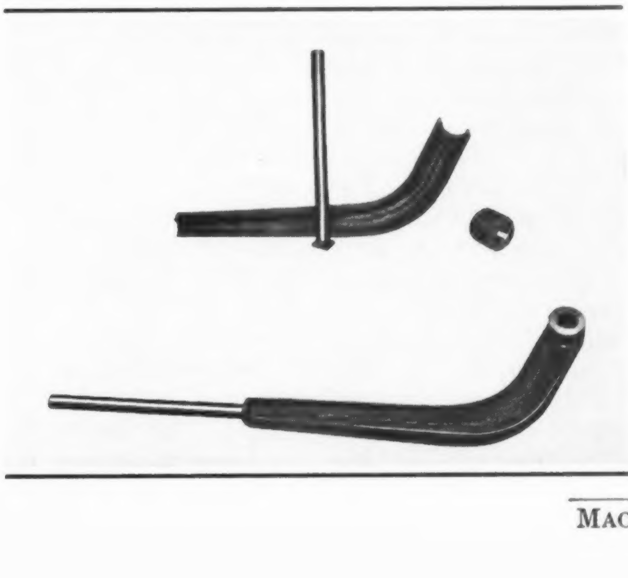
While the absence of moving parts means greatly reduced maintenance, the question naturally arises as to the frequency with which the tubes themselves will have to be replaced. Thyratron tubes of the type used for welding have an average life of 10,000 hours, which, on the basis of six ten-hour days per week, would indicate about a three-year replacement. This would be correspondingly increased or reduced as the actual working period per day varied.

Arc-Welding Handles of Paper-Making Machine Knives

Lighter weight, stronger, faster, and less costly construction, and greatly improved appearance have resulted from using arc welding in the fabrication of handles for operating the knives of paper-making machinery. These handles are 51 1/2 inches long and weigh approximately 32 pounds each. They were fabricated for a manufacturer of paper-making machinery by the Contract Welding Co., Cleveland, Ohio.

The handles consist of six parts—a piece of standard tubing, two T-shapes, a piece of hot-rolled steel plate, a piece of standard steel pipe, and a plug. The piece of tubing, which forms the hub of the handle, is 3 1/2 inches long by 2 3/4 inches outside diameter. The T-shapes are 36 inches long with 1 3/4-inch vertical and horizontal legs. The piece of hot-rolled steel plate is 1 3/4 inches square by 3/8 inch thick. The standard steel pipe is 20 inches long by 1 inch in diameter. The plug is 1 5/16 inches in diameter by 1 inch long. The fabricating of a complete handle by arc welding requires only an hour and a half, using equipment made by the Lincoln Electric Co. The two T-bars are first bent to the proper curve and then put in a jig and welded. The piece of tubing, or hub, is next welded to the T-bars. The plug is then welded into the end of the steel pipe, forming the upper end of the handle. After the plug is welded in, the pipe is chromium-plated for 16 inches of its 20-inch length.

The next operation is the welding of the 1 3/4-inch plate to the end of the plated handle. At this stage, the handle is in two pieces. All that remains to be done is to weld the two parts together. This is done by welding the lower part, consisting of the hub and two T's, to the square piece of plate on the lower end of the pipe handle. The handle assembly is now complete. All the welds are then ground, the parts cleaned, and the whole unit given one coat of paint. A keyway is now cut in the hub and a hole drilled and tapped for a setscrew. These arc-welded handles were formerly made of cast iron.



Arc-welded Handle for Operating the Knife of a Paper-cutting Machine. Upper View Shows Handle Partially Fabricated; Lower, Completed Handle

Making Models from Easily Machined Material

Samples and Models are Easily Made from a Material Known as "Lava," which Can be Machined with Tools and Cutters of Cold-Rolled Steel

By L. J. GREENAWALT, Engineering Department, Westinghouse Electric & Mfg. Co., Mansfield, Ohio

THE material called "lava" has proved an excellent material for models of electrical products because of its exceptional dielectric strength, the ease and speed with which it can be machined, and the low cost of the tools and cutters required. The engineer receiving a sample made from this material can use it not only to check the design, but to run tests as well. Models of electric heaters, carved handles, switches, and other parts, especially those that must resist high temperatures, would be very expensive to make of ordinary refractory materials.

This rock-like material called "lava," talc, or soapstone, depending upon the grade, is a soft mineral found in the Appalachian region. It is oily and yielding to the touch. As a dielectric, it withstands high potentials with remarkable uniformity for an indefinite period. The electric arc has no effect on it, and it is impervious to temperatures of 2000 degrees F. and higher.

Lava is so soft that it can be scraped with the finger nail; hence special tools are not required for machining. For instance, a carpenters' saw is used for cutting it and a wood chisel for working out corners where it is impossible to use a milling cutter. Cutters made up of cold-rolled steel are sufficiently hard to machine lava satisfactorily.

In making a model—an electric breaker base, for example—a block is sawed out to the required size, allowing 1/8 inch for the finishing cut. The block is then machined to exact size on a lathe or milling machine, depending on the size or shape of the part.

The block is laid out according to the drawings, deep lines being scratched with a scriber. It is then clamped on the table of the milling machine. The deep sections are milled first, working up to the shallow sections last. When this system is used, the block can be machined with one lay-out. The tools can be run at high speed, but a light cut must be taken and the dust must not be allowed to pack around the tool. Compressed air, directed against the cutting point, is the best method of keeping the milling cutter clean and the lay-out lines clear.

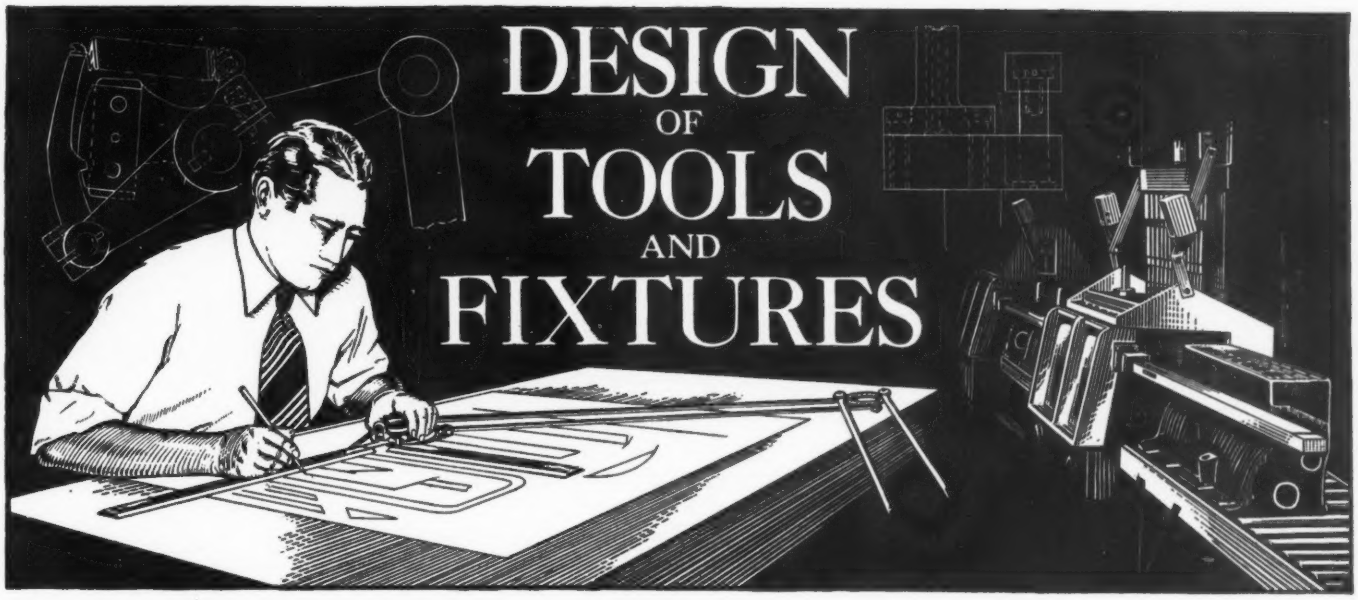
In drilling, the feed should be fast, but the drill must be removed often and tapped lightly to remove the dust; otherwise the dust might cause the drill to bind and break the lava. The tools used for drilling or counterboring holes, the bottoms of which are irregular in shape, are made from pieces of cold-rolled sheet steel approximately 1/16 inch thick, cut to the required shape. Each sheet-steel piece is attached with soft solder to a cold-rolled steel rod of the right size to fit the chuck. It is not necessary to caseharden drills of this kind that are used for model work. Side cutters for the milling machine can be made in the same way.

Lava can be drilled and tapped the same as metal, and rods made of this material can be threaded. After machining, the block is assembled or the mechanism is mounted on it to check dimensions and clearances. This procedure is necessary because the lava is hardened by "firing" after machining. After firing, the model is so hard that it cannot be ground with an emery wheel.

In the firing process, the moisture is first driven out by drying in a slow-heating oven with the highest temperature not exceeding 200 degrees F. If the temperature is raised above 212 degrees F. before the material is thoroughly dried, the steam generated will crack the lava. After the drying process, the block is placed in an electric furnace with a higher temperature rating. The heat is increased slowly until a temperature of at least 1750 degrees F. is reached. The block is then allowed to soak at this temperature, the length of time depending on the size of the block or the thickness of the walls. Shrinkage resulting from firing is so slight that no allowance is necessary unless the part is exceptionally long.

* * *

The savings that can be made in a manufacturing plant do not pertain only to production equipment. The installation of auxiliary equipment of different types may also result in substantial savings. For example, two months after the installation of a General Electric Pyranol capacitor equipment at the Richman Brothers Co.'s plant in Cleveland, Ohio, the power factor was improved from 72 to 90.7 per cent and the company's power bill was reduced $110, or an average of $55 a month. At this rate, the saving will pay for the equipment in about eighteen months.



Drill Jig with Centralizing Device

By PHIL E. VERAA, Richmond Hill, N. Y.

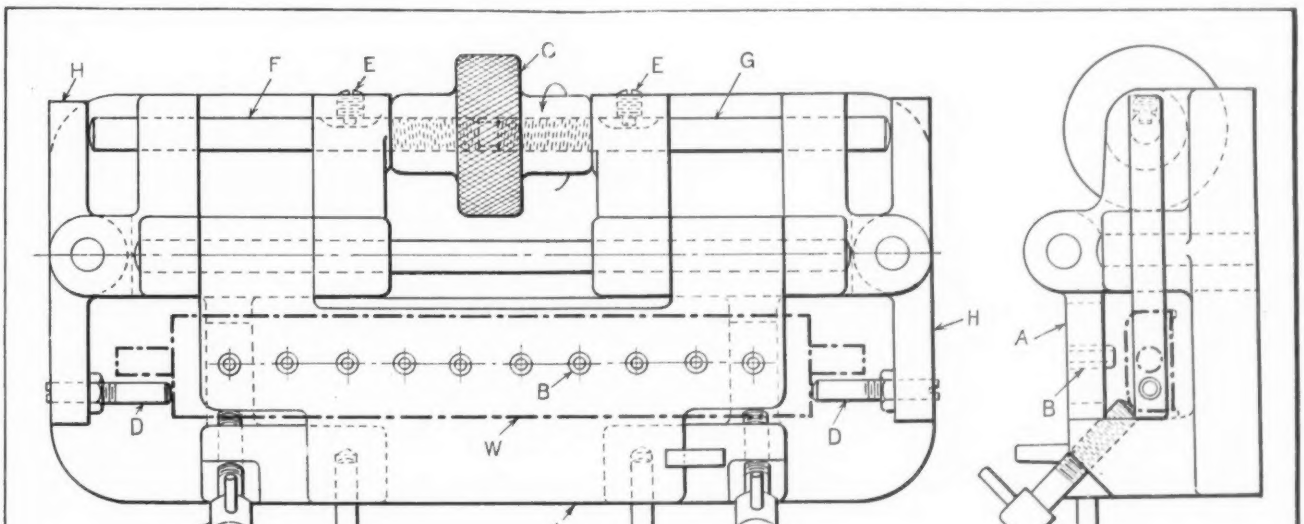
The jig here illustrated is designed for use in drilling and tapping ten 10–32 holes in the part *W*. As the parts to be drilled vary somewhat in length and as the groups of drilled holes are required to be centrally located, provision is made for drilling and tapping the holes to meet this requirement.

To load the jig, the cover *A*, carrying the ten drill bushings *B*, is raised and the work *W* placed in the position shown. The knurled nut *C* is then turned in the direction indicated by the arrow, causing the locating studs *D* to move inward uniformly, so that the work is centralized in the jig. The centralizing movement is obtained by having a right-hand thread cut in one side of the knurled nut *C* and a left-hand thread in the other side. The shouldered screws *E*, which fit into keyways in studs *F* and *G*, prevent the studs from rotating when nut *C* is turned. This results in imparting the required centering movement to the adjustable studs *D* through the pivoted levers *H*. The final clamping is effected by tightening studs *K*.

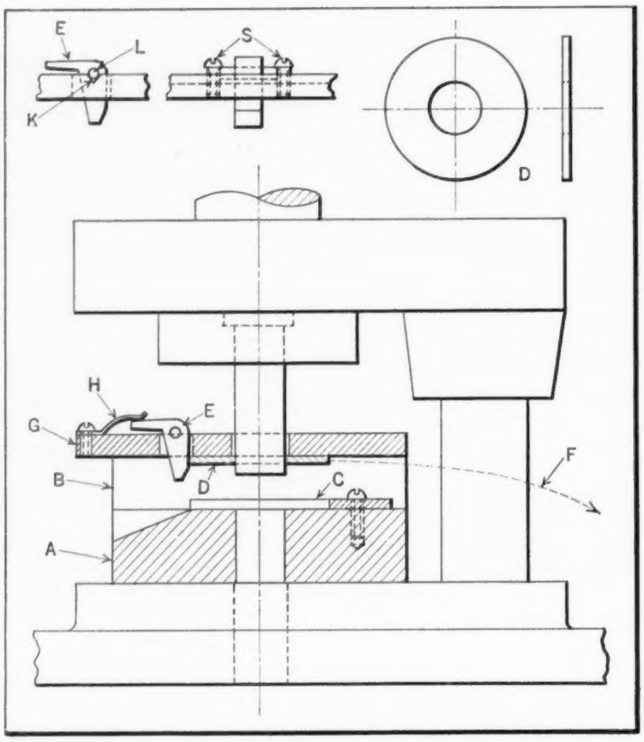
Ejector for Piercing Dies

By H. R. SCHMIDT, Philadelphia, Pa.

In the absence of an air pressure system for blowing the work out of piercing dies, a very effective ejector can be made as shown in the accompany-



Drill Jig Having Work-centering Studs D Actuated by Knurled Nut C



Piercing Die Equipped with Spring-actuated Ejector

ing illustration. This type of ejector is suitable for a great variety of work.

The illustration shows the press on the return stroke after piercing the hole in a washer *D*. On the down stroke, the lower end of ejector *E*, coming in contact with the work, is swung back in a clockwise direction against the pressure exerted by the flat spring *H*. Thus, when the punch raises the work out of the nest *C*, and against the bottom of the stripper *G*, and finally clears the work, the ejector snaps back and ejects the piece clear of the die *A* along the dotted path indicated at *F*. This ejector is especially effective when used in conjunction with a magazine feed.

The method of mounting the ejector consists of cutting a 90-degree V-groove across the face of the stripper, as indicated at *K* in the view in the upper left-hand corner of the illustration. The short fulcrum pin *L* is held in the V-groove by the screws *S*.

Transfer Die for Producing Tubular Spacing Collars

By FRANK J. MAILE, Tool Engineer
Philadelphia, Pa.

Manufacturers of radio equipment and other apparatus of similar construction usually require large quantities of tubular spacers, such as shown at *A* in the accompanying illustration. At first thought it would seem logical to make these spacers from seamless tubing, cut up into pieces of the required length on an automatic screw machine. This method is quite economical, provided the manufacturer has the screw machines available. However, the punch and die shown in the accompanying illustration, which was designed by the writer, will give far greater production per hour and cut the cost of manufacture. This punch and die is of simple construction and comparatively low in cost. It is designed to cut off and form the spacing collars from flat ribbon stock.

The die illustrated can be designed for any size tubular spacers likely to be required for radio or similar equipment. The ribbon stock is mounted on a reel and fed into the punch and die by an automatic feeder attached to the punch press. Thus the press requires little or no attention. Even if the stock has to be fed by the operator, the cost of production will still be far less than when the spacers are made from seamless tubing.

The particular die illustrated is designed to produce spacers having an inside diameter of 1/4 inch, an outside diameter of 5/16 inch, and a length of 3/8 inch. The die-shoe *B* is of ordinary design and can be purchased on the market. The die-block *C* has a slot *D* into which the cutting-off punch *E* descends, cutting off the stock to the required length. The die-block to the left has a semicircular groove *F* machined in it to a depth of half the outside diameter of the spacing collar to be formed. The width of this groove is the same as the outside diameter of the tube.

An ordinary stripper *G* is provided to guide the stock and to strip it from the cut-off punch. A permanent stop with a hardened piece *H* fastened to it serves to receive the thrust of the in-feeding stock and to maintain the length of the blank. Shims can be inserted at the back of the piece *H* to adjust the length of the blank.

A round piece of stock *I* equal to the outside diameter of the spacer is screwed into the slide *J*; this piece transfers the blank after the first forming by punch *K* to the position for the second forming operation, performed by punch *L*. After the second forming operation, each tube ejects the one preceding it, pushing it out of the semicircular groove into a pan or box. The slide *J* moves back and forth in rectangular grooves machined in the guides fastened to the die-shoe.

The movement of slide *J* required for transferring the work from one stage to the other is produced by the action of cam *M*. As the press ram descends, the cam enters the rectangular slot in slide *J* and draws the slide backward against the tension of spring *N*. On the return stroke, the spring punch pushes the slide forward as the press ram ascends, thereby transferring the work from one position to the other.

The width of the forming punch *K* at the semicircular end is equal to the inside diameter of the tube to be formed. The width of the punch just back of the end, however, is smaller than the inside diameter of the tube. This reduction in width is made to allow the sides of the piece to be over-bent, so as to compensate for spring-back.

The pin O which passes through punch K serves two purposes. First, it strips the piece from the punch; and second, it holds the piece in place after it has been sheared and until the punch has descended to the point where it begins the forming operation. The cut-off punch E is made just enough longer than the other two punches to permit it to completely cut off the piece to be formed before the other punches come in contact with the work. Thus the stock will be left free for the forming operation without interference from the cutting-off punch. The cutting-off punch is fitted to the slot in the die-block C. The length of the tongues Q on the punch E is made about three times the thickness of the stock. These tongues serve to guide the punch and to steady it during the cutting-off operation, thus increasing the life of the edges of both the punch and die.

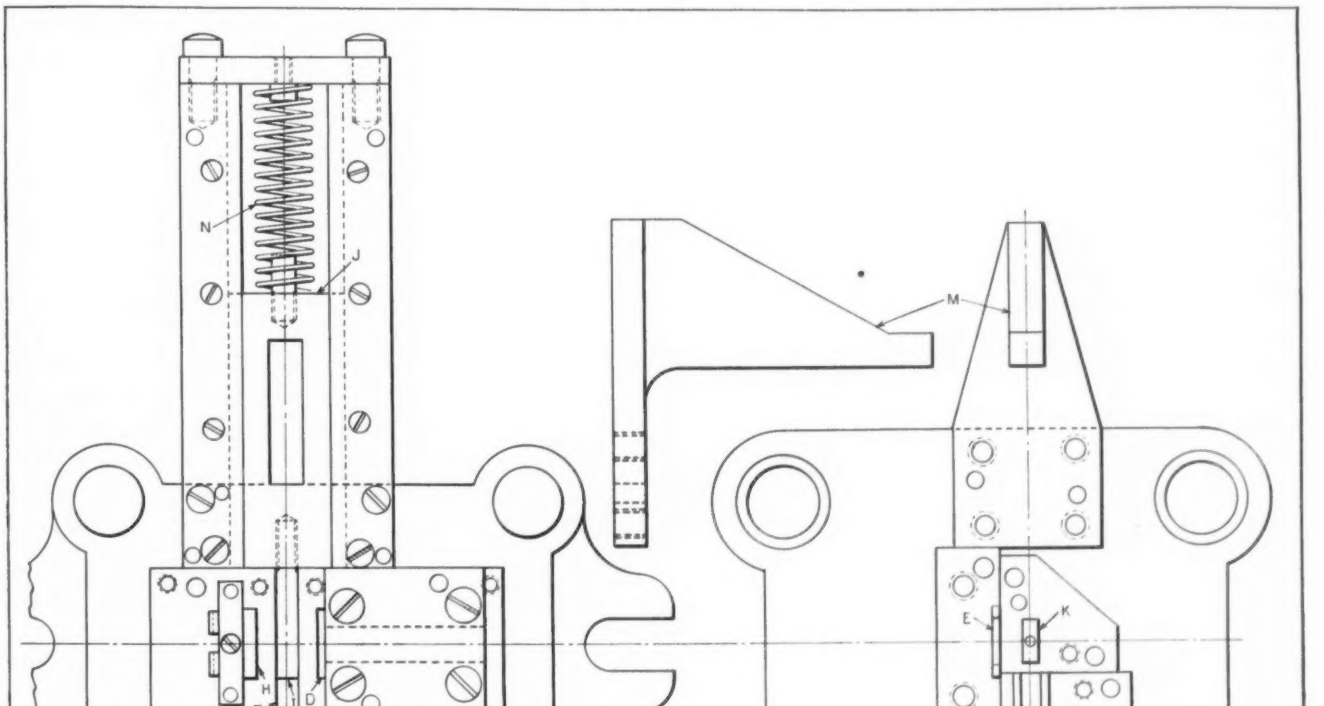
The punch L completes the second and final forming operation on the tube. It has a semicircular groove machined to the radius corresponding to the outside diameter of the spacing tube to be formed. The screw R which extends into the punch-holder permits adjusting the pressure exerted by the spring S, which strips the formed piece from the punch K.

The cross-section X–X shows how a slot is machined in the shoe B at an angle in order to permit the formed pieces to fall free from the die into a box or container.

Progressively Indexed Holders for Boring and Reaming Cylinder Blocks

By CHARLES C. TOMNEY, Chief Tool Designer
Carrier Engineering Corporation, Newark, N. J.

Each of the four semi-steel cylinder blocks shown clamped in individual sliding work-holders on the Moline Hole Hog in Fig. 1 has two 4 1/4-inch diameter bores that are 9 1/16 inches long. Only 2000 of these blocks are required a year. The bores of all these cylinder blocks are rough-bored, semi-finished, and reamed with the machine equipped as



Die for Producing Tubular Spacing Collars from Flat Stock

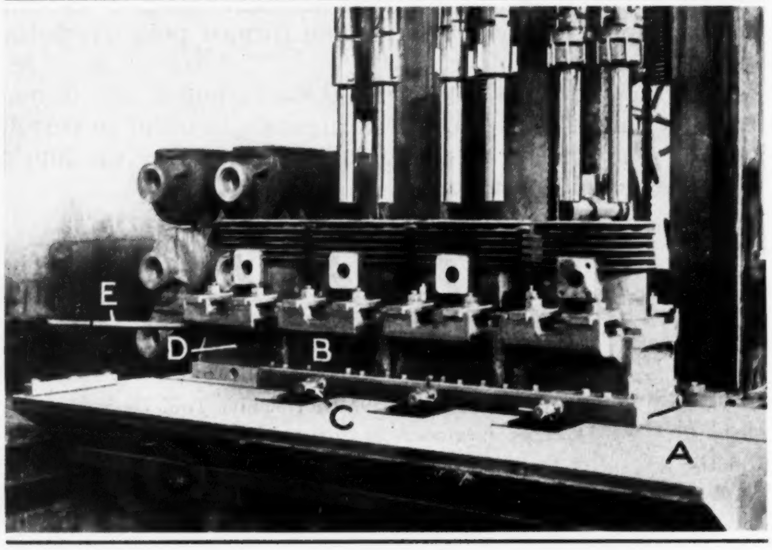


Fig. 1. Rough-boring, Semi-finishing and Reaming Cylinder Blocks on Moline Hole Hog Equipped with Special Fixtures

shown. The cylinders are secured in their individual holders with ordinary clamps. The operator of the machine also operates the honing machine which finishes the bores within the required limits of 4.251 and 4.250 inches.

The base *A* of the fixture is made of cast iron. Each cylinder has its own work-holder *B*, and each work-holder has its own pilot bushings. When the job is started, only the work-holder *B* is in position ready for the cylinder to be rough-bored. After this cylinder is rough-bored, the indexing pin *C* is withdrawn and the second holder *D* is advanced to the rough-boring station, the first holder *B* being advanced to the semi-finishing station by means of the lever *E*. The details of lever *E* are shown in Fig. 2.

After the semi-finishing operation is completed, the third holder is moved into the rough-boring position and the first cylinder is advanced to the reaming position, the second holder moving up to the semi-finishing position. From then on, a finish-reamed cylinder is produced at each stroke of the machine. It will be noticed that a fourth work-holder is provided so that a rough cylinder can be clamped in place while the other operations are being performed.

After being reamed, the cylinder is placed in the honing machine and a rough cylinder is clamped in position ready to be rough-bored. Each work-holder has its own indexing pin and the holders are machined to an exact length, so that when the first one is in line, all others are automatically lined up with their respective indexing pins.

* * *

Both high-speed steel and tungsten-carbide tools work better with a honed edge.

The British Machinery Industry

According to information obtained from the Machinery Division of the Bureau of Foreign and Domestic Commerce, American Consul William W. Heard, of Birmingham, England, reports that the machine tool industry, in the Birmingham district especially, continues to run at high pressure, the activity being greatly in excess of what it was a year ago. Many plants report 75 per cent more business for the last quarter of 1934 than for the same period a year earlier.

The present activity in the machine tool field is due to the improved conditions in the general engineering and metal-working industries. The marked activity in the automobile industry has created a steady demand for all classes of automobile shop equipment. There has also been an increased demand for machine tools in the bicycle and motorcycle fields.

The exports of British machine tools for the first eleven months of 1934 were valued at approximately $7,250,000 as compared with $6,000,000 a year ago. Apart from Soviet Russia, the principal markets continue to be the British Dominions. There has, however, been a considerable decline in the exports to Soviet Russia.

Recently arrangements have been made for cash payments for machinery and equipment purchases made by Soviet Russia in Great Britain. The reason for the cash basis of payment is stated to be the excessive cost of time credit, amounting, for the government guarantee alone, to 7 per cent. According to dispatches from Great Britain, orders were placed in January valued at more than $5,000,000 for machinery and equipment on a cash basis. Large orders for high-grade steel have also been placed recently.

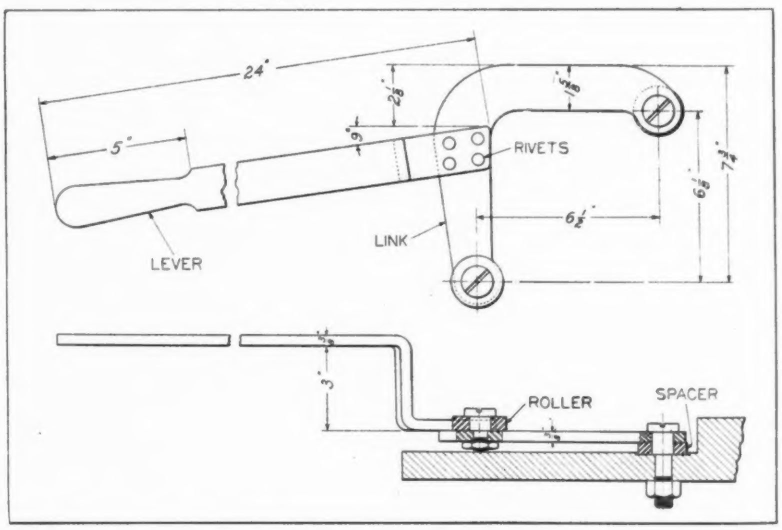


Fig. 2. Lever Used to Move Work-holders Shown in Fig. 1 into Successive Machining Positions

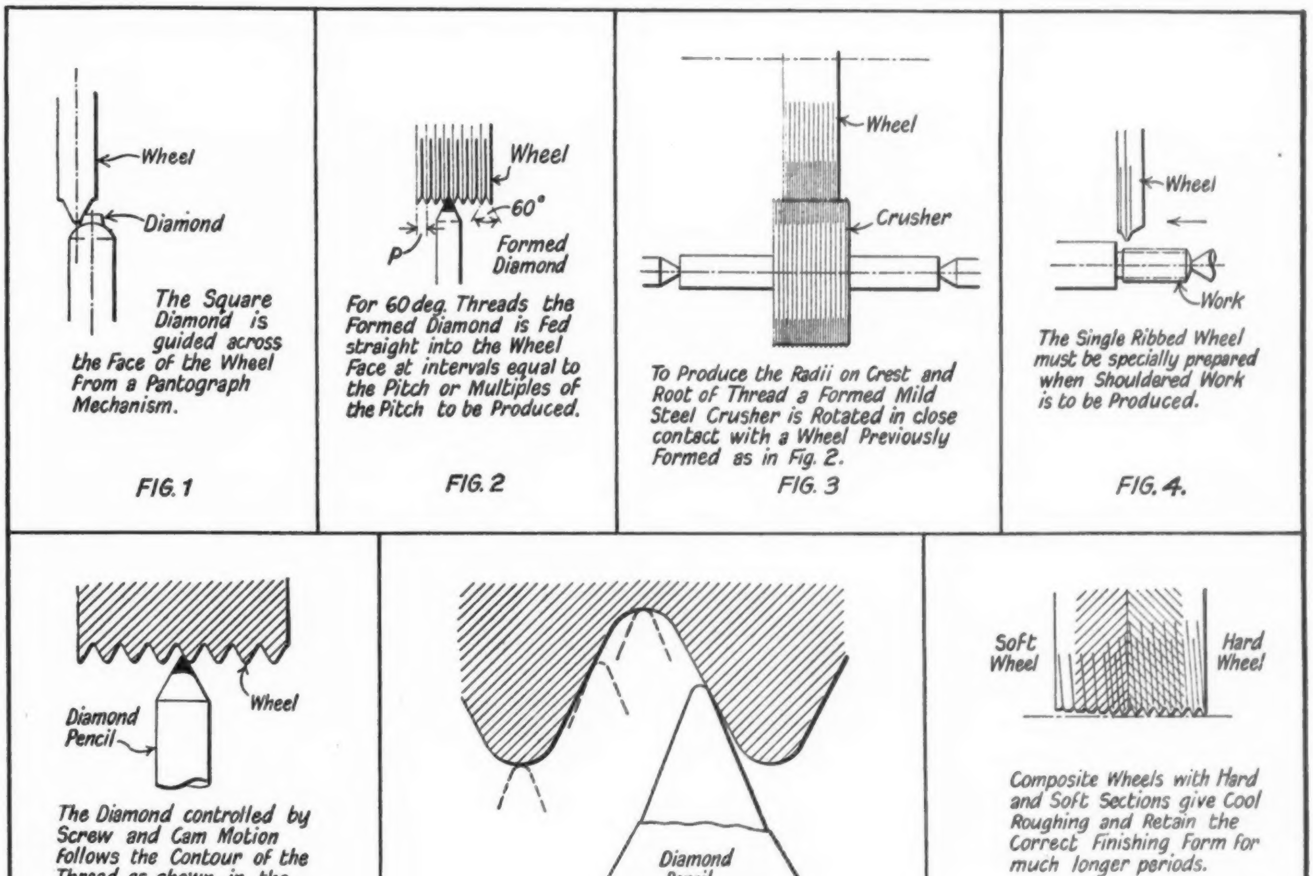
European Thread Grinding Practice

Types of Wheels Used for Thread Grinding and Equipment Employed for Finishing Wheel Profiles to Correct Form

THREAD grinding machines developed by British and Continental makers differ somewhat in their methods of operation, particularly as regards the method of producing the thread form on the wheel face. On one British machine, the wheel profile is obtained by means of a pantograph and a special stylus point working in conjunction with a diamond that passes across the face of the wheel as the stylus is moved around the profile of a former. This apparatus is permanently fixed to the machine and allows the wheel to be dressed as often as necessary.

Fig. 1 indicates the shape of the diamond and the form imparted to the wheel. It would be impossible, of course, to produce multi-threads on a wheel by this system of dressing. Even if the shape of the diamond were modified to allow several ribs to be formed on the wheel face, the length of the former, which is twenty-five times the full size of the thread, would be too cumbersome for convenient mounting. Thus if the normal working width of the wheel for production work is 1 inch, a former 25 inches in length is required.

This machine appears to operate efficiently on a wide range of work such as small taps and screws, where large quantities warrant the adoption of a more or less special machine. One of the salient features of the design is the high work speed, which, in conjunction with the rapid table and lead-screw movements, does not permit of heavy cuts, the work being traversed to and fro many times. In order to increase production and prolong the life of the finishing wheel, it is the usual practice to first rough out the threads on a lathe or screw machine, the thread grinder being used simply as a finishing machine. For normal work where extreme accuracy is not essential and high finish is not required, this machine appears to be quite efficient.



Figs. 1 to 7. Diagrams Illustrating Various Forms of Thread Grinding Wheels and Methods of Truing

A machine of Swiss design also uses the single-rib wheel, but has no easy means for forming the wheel to any desired shape. This machine is designed mainly for the production of short and long threads of Acme form, such as are encountered in lead-screws of lathes. It is extremely accurate, but cannot be termed a high-production type. It resembles a lathe, the normal toolpost being replaced by a grinding wheel quill which can be rotated through about 10 degrees to eliminate interference on threads having high helix angles. The truing diamond is mounted on combination slides and fed across the wheel face at the angle required for forming Acme, buttress, sharp vee, worm, and similar threads. The fixture does not permit forming the radii at the crest or root of the thread, which must be done later with a metal wheel, as will be explained subsequently.

Multi-Rib Wheel with Radii Formed by Wheel Crusher

Another machine of Continental design embodies features that render it suitable for the high production of taps with or without relieved lands. It is provided with means for jumping across the flutes of taps at high speed to reduce the time that would otherwise be lost in idle movement. This machine works on the heavy-cut and slow-speed principle. Single-rib or multiple-rib wheels can be used. Means are provided for dressing these wheels with a diamond fed into the wheel face at regular intervals corresponding to the pitch of the thread to be produced. This method is quite satisfactory for U.S.S. or similar threads which have no radii at the crest or root.

For Whitworth and similar threads, the serrated wheel must be modified by using a crusher. As shown in Figs. 2 and 3, the wheel is serrated by means of the diamond and crushed by means of a carefully turned cylinder, the periphery of which has perfect thread forms such as are required on the screw to be ground. The cylinder is mounted concentrically on a true mandrel and rotated in close contact with the wheel. Contact is thus maintained as close as possible until the roots and crests of the wheel threads are correctly formed. This brings the wheel to the shape of the former or crusher, and the particles broken off are embedded in the surface. This method has been employed successfully for a number of years. Its disadvantage lies in the cost of producing accurate crushers, which naturally do not withstand rough usage or retain their correct form.

Machine with Truing Diamond Controlled by Lead-Screw and Cam

Another British machine has recently been developed that appears to embody all the advantages of the previous machine. Single or multiple wheels can be used, and both medium and slow speeds can be employed for the work-slide. High work speeds have been definitely avoided in order to obtain greater accuracy. Both single- and multiple-rib wheels can be dressed with ease by utilizing a mechanically operated fixture which is permanently located on the headstock of the machine and can be swung quickly into position and locked.

The wheel form is obtained by means of a cam, which, used in conjunction with a lead-screw, permits right-hand and left-hand threads to be ground. The wheel can be tilted through 15 degrees to the right or left to avoid interference when cutting multiple threads. The wheel can be withdrawn rapidly from the work when necessary. This is an advantage when threads are to be ground close to a shoulder.

Another method would be to rotate the work in the opposite direction and cut outward toward the tailstock center. Fig. 4 shows the disadvantage of a single-rib wheel when cutting up to a shoulder. The rib must be located as close to the edge of the wheel as possible, rendering the rest of the wheel useless.

The wheel truing is performed as shown in Figs. 5 and 6. A shaped diamond is employed, only the radius of which is utilized to form the thread. This is located by means of the rotating cam which is controlled by the machine spindle. The point of the diamond passes over the face of the wheel, as shown in Fig. 6. This feature is patented. In addition to pitch control, the threads of the wheel can be controlled as regards effective thickness by means of an auxiliary control. The machine has rapid flute-traversing motions that can also be used when required for relieving the lands of taps. The relief can be instantly adjusted to any desired amount, while change-gears are provided to allow for relieving helical taps, worm hobs, spiral cutters, and similar special jobs. A reverse feed is available which permits the machine to cut in both directions on long work, backlash of the gears having been eliminated.

Importance of Correct Work Speed and Wheel Grading

For thread grinding, as for ordinary cylindrical grinding, the work speed and the wheel speed are of paramount importance. Free cutting is essential, and this can only be obtained by utilizing the correct grain and grade of wheel. Hard wheels retain their form longer, but only at the expense of the rate of metal removed, undue work heating, and inaccuracy of work diameters. Soft wheels require frequent dressing. This is a drawback, but often worth the trouble when it can be performed easily. The utilization of the composite wheel presents advantages. This consists of a double wheel having a soft and a hard face, as shown in Fig. 7. The soft face removes the bulk of the metal while the hard portion cleans up and finishes the thread.

Selecting Set-Screws Having Required Torsional Holding Power

By A. L. HARTLEY and C. R. MEESE

THE writers of this article have conducted a number of experiments with a view to determining definitely what sizes of set-screws to use in order to obtain the required holding power when the torque in pound-inches is known. These experiments were conducted with both round-point and cup-point set-screws.

The results of these experiments are given in the accompanying charts. It has not been deemed necessary in this article to go into details as to the method of conducting the experiments, although these methods were selected with a view to assuring as great an accuracy in conducting the experiments as possible. In the tests, the set-screws were set to 90 per cent of the maximum strength of a standard hexagonal bar type wrench.

The experimental data were used to plot the curves, Figs. 1 and 2, and also to calculate equations by which the torsional holding power of set-screws can be expressed. The equations that express the torsional holding power are:

For round-point set-screws,

$$T = 7900 \times D^{3.6}$$

For cup-point set-screws,

$$T = 8100 \times D^{3.6}$$

In these equations,

T = torque, in pound-inches; and
D = diameter of set-screw, in inches.

It should be noted that all the tests were conducted with headless set-screws. The performance of the set-screws themselves proved highly satisfactory, none failing under the tests. The failure was in the mild steel shafts used in the experiments.

Proper sizes of set-screws to transmit a given torque can be selected directly from the curves in Figs. 1 and 2. If it is required to transmit a given horsepower, the required torque can be found by using the equation:

$$T = \frac{63{,}024\, H.P.}{n}$$

in which

T = torque, in pound-inches;
$H.P.$ = horsepower it is desired to transmit; and
n = revolutions per minute.

It should be noted that the ordinates in the curves are in pound-inches, obviating the necessity of using the radius of the shaft in the torque formula above. It will be seen that the curves for the two types of screws are almost identical.

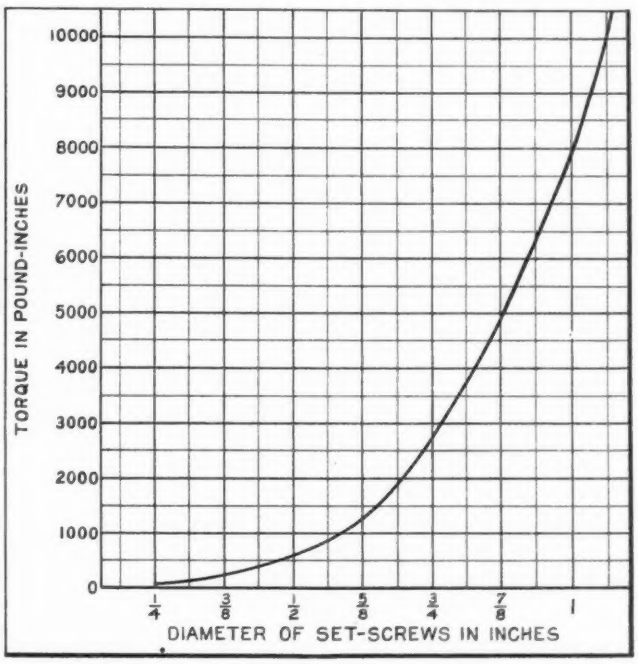


Fig. 1. Curve for the Selection of Set-screws with Round Point

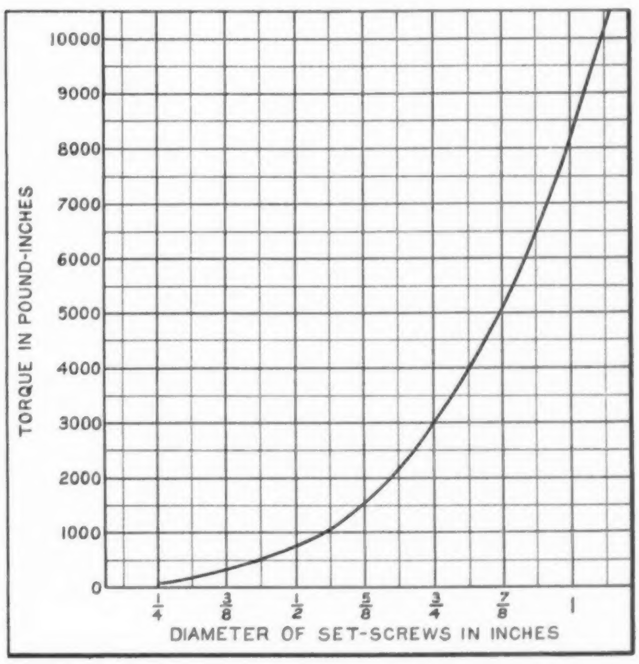


Fig. 2. Curve for the Selection of Set-screws with Cup Point

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

R. S. J.—Which of the different materials used for pipes, exclusive of the non-ferrous metals, is the easiest to thread and how can it be identified in a lot consisting of pipes of different materials?

A. — The principal metals employed in making pipe are wrought iron and steel. In purchasing iron pipe, wrought iron should be specified, as otherwise, genuine wrought-iron pipe may not be secured. Of the steel used for pipe, there are two principal classes, depending upon the process of manufacture, namely, open hearth and Bessemer. Each of these steels possesses different working qualities and characteristics. Open-hearth steel is very difficult to thread properly with threading equipment such as is used in some jobbing shops. Bessemer steel will thread more readily. Genuine wrought-iron pipe can also be threaded without difficulty.

The comparative machining qualities of pipe can be determined by the following test: File and clean a bright spot on the pipe and apply nitric acid. The acid will leave a dark spot on steel; the darker the spot, the harder the steel and the more difficult it is to thread. Genuine wrought-iron pipe remains bright when touched with the acid.

Effects Produced by Alloys on Chilled and White Iron Castings

E. R. B.—What are the principal alloys used in chilled and white iron castings, and what properties are imparted to the castings by the different alloys?

A.—Some of the alloys produce their most beneficial effect only when used with another alloy. The following information from a 160-page symposium on cast iron, published recently by the American Society for Testing Materials and the American Foundrymen's Association, shows the effects produced on chilled and white iron castings by alloys generally employed for these materials.

Chromium—When used without other alloys, chromium increases the depth of chill and, by increasing the carbides, also increases the hardness. Chromium frequently is alloyed with nickel, molybdenum, or copper, and some investigators suggest a chromium-aluminum alloy.

Nickel—Nickel is rarely used in chilled castings without another alloy—usually chromium. When used alone, it reduces the depth of chill. The core is strengthened due to a more even distribution of the graphite. Nickel reduces the chill nearly one-third as much as an equal amount of silicon.

Nickel and Chromium—Nickel and chromium should be considered alloyed together, as well as separately. It is usually considered that one counteracts the bad effects of the other and supplements the good effects. A correctly alloyed nickel-chromium iron produces a hard close-grained casting that is very resistant to wear.

Molybdenum—Molybdenum in chilled iron increases the strength, but does not apparently affect the hardness. Molybdenum, however, does increase the wear resistance to some extent.

A copper-molybdenum alloy has proved satisfactory for rolls requiring strength and heat conductivity.

Vanadium—Vanadium in white and chilled cast irons is of value in the refining of the dendritic structure, thus producing a tougher metal, as indicated by impact tests.

Copper—Copper tends to reduce the depth of chill. It is seldom used alone as an alloying element. The usual combination is copper-molybdenum or chromium-copper-molybdenum.

Aluminum—Aluminum as an alloying element in chilled iron has not been completely investigated. It is definitely known that it is a strong graphitizing and deoxidizing agent, and therefore reduces the depth of chill.

Aluminum is only half as effective in reducing white iron to gray as silicon. One decided disadvantage attributed to the use of aluminum in iron is that considerable gas is evolved during the pouring operation, which causes blow-holes.

Importance of Oil Color

S. C.—For years I have been hearing conflicting statements regarding the importance of color in lubricating oils. Please set me straight on this point.

Answered by the Editor of "Oil-Ways," Published by the Standard Oil Co. of New Jersey

The color of a new oil is generally no indication of its lubricating qualities. When it is to be used in an internal combustion engine, it may be taken as an extremely rough indication of its carbon-forming tendency. Color of used oil indicates to some degree the extent of oxidation and contamination that has taken place. In general, little importance can be attached to oil color.

Savings Achieved by Motorizing Shop Equipment

By G. A. SOHL, Motor Application Engineer
The Lincoln Electric Co., Cleveland, Ohio

THOUSANDS of dollars in maintenance costs have been saved by the Cleveland Steel Products Corporation, Cleveland, Ohio, by installing self-contained electric motor drives on a wide variety of machines. In a number of cases, equipment that might otherwise have been discarded was placed in successful operation by the installation of individual motor drive. In other instances, the motor drive was applied to comparatively new machines because of the savings and the convenience obtained. The operating conditions of the company are such that a considerable saving in power is also derived as a result of the installation of individual drives.

Before undertaking to motorize a plant in this manner, a thorough survey should be made in order to determine the feasibility and economy of the conversion program before any alterations are begun. In the case of the company referred to, studies were made of power costs with existing equipment, compared with the costs when direct motor drive was used. Maintenance costs of present lineshaft driving methods were compared with those of the motor drives. The result of this study, and the success experienced with early conversions, prompted the company to go ahead with its program. Up to the present time, more than thirty machines have been provided with direct motor drive. The company is planning to continue to replace gradually the old drives by single-unit motor drives.

Typical of the many conversions worked out is the line-reaming machine shown in Fig. 1, which was originally driven by belt from overhead shafting. In applying the motor drive, numerous other modernizing improvements were also made. It will be noted that a special mounting was built up on the head of the machine. This consists of two 2-inch angles joined by arc welding to two brackets made of angles 1 1/4 inches wide by 3/16 inch thick. The motor—a Linc-Weld one-horsepower unit operating at 900 revolutions per minute—is bolted to the 2-inch angles with a vibration-absorbing material between the motor supports and the mounting. A small gear, keyed to the motor shaft, meshes with a large gear mounted on the main spindle. Cutting oil is carried to the reamer by a pump which is mounted on the bracket at the forward end of the machine and driven by a belt from a pulley on the motor shaft.

Another example of what can be done in applying motor drive to a machine is shown in Fig. 2; in this case, a lathe has been provided with a 3/4-horsepower motor. The motor is bolted to a 7-inch channel which is supported on a 7/8-inch pin

Fig. 1. A Machine Converted to Motor Drive by the Installation of a One-horsepower Electric Motor, and Modernized by the Effective Use of Arc Welding

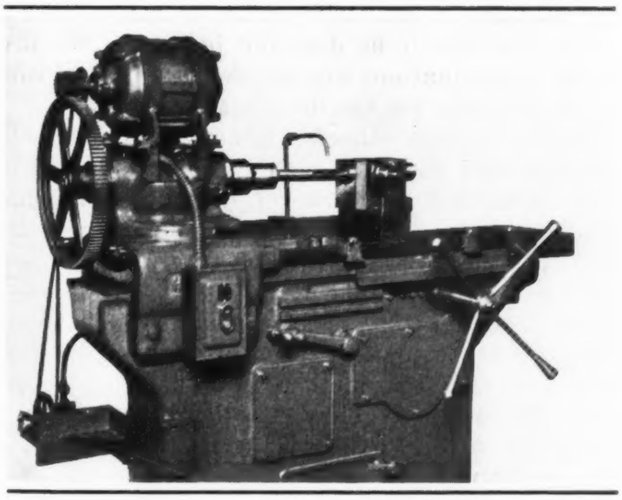
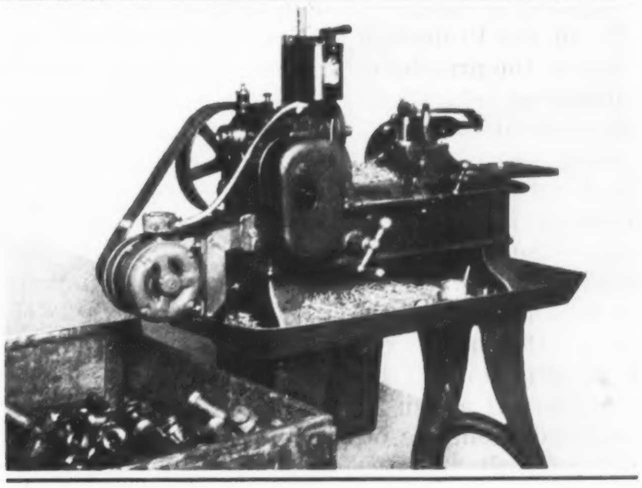


Fig. 2. This Lathe is Now a Self-contained Unit, Driven by a 3/4-horsepower Electric Motor Supported at the Forward End by a Welded Bracket



welded inside the channel and extending on both sides into brackets bolted to the forward end of the lathe bed. Because it is free to swing, this type of mounting has two definite advantages. It compensates for the torque of the motor caused by sudden starting, and it keeps the belt tight.

In making the mounting for the motor, V-shaped pieces were cut out of each side of a piece of 7-inch channel. The channel was then bent and welded.

The motor is controlled by a lever at elbow height. The machine is brought up to full speed in less than a second by moving the lever to the right, and stops practically instantly when the lever is thrown all the way to the left. The pushing of the lever to the left reverses the motor, but the lever is instantly "kicked" from the reversing position to the neutral position. The operation of this particular lathe requires the starting and stopping of the motor about ten times a minute.

As an indication of the saving made by operating this machine with an individual motor drive, the following data are of interest: Orders often have to be filled that make it necessary to operate this machine over-time. When belt-driven from an overhead lineshaft, a 30-horsepower motor had to be kept running to transmit power to the machine. Now, only a 3/4-horsepower motor needs to be operated. Considerable savings in maintenance costs are also apparent. The clutch mechanism used in the past soon wore out by continuous starting and stopping. Eliminating this clutch mechanism has saved a great deal in maintenance costs.

Do Our Methods of Engineering Education Serve Their Purpose?

By CLEMENT J. FREUND
Dean of the College of Engineering, University of Detroit

"You have the finest engineering schools in the world, with the very best equipment; but you keep your students so busy passing examinations that they have no time left for studying engineering." That is what a distinguished German professor of engineering had to say about American engineering education when he was here not long ago to deliver a series of lectures in an engineering school.

Perhaps he is right. Perhaps, on the other hand, he forgot to take into account one or more factors that enter into the problem. This is no reflection on the professor; it is difficult enough to see everything in its true perspective in one's own country, let alone getting accurate impressions during a brief visit on foreign soil. "Engineering varies in function and practice from nation to nation, and the variety of national types is worth preserving as a spur to progress," says the Report of the Investigation of Engineering Education, by the Society for the Promotion of Engineering Education.

And as the practice of engineering varies, so does engineering education. If German visitors here and our visits to Germany give us the correct impression, the purpose of German engineering education is to serve the profession and the state by producing a highly professional and scientific engineer—the research-minded sort of person who comes out of our graduate schools. Such students love to study, and their enthusiasm keeps them on the job. German educators, with this type in mind, simply offer courses. They know that these students will take full advantage of the courses, and they care little about the others.

In the United States, we do it differently. The welfare of the average individual student determines our methods and procedures. Of course, we are happy whenever a brilliant student goes on to get his master's degree and his doctorate, and in recent years we have given much more encouragement to research and researchers. But American engineering education has been largely democratic —an effort to prepare the average student for useful work in the industries. However, the average student is not always an effective student. He wants to become an engineer, and often is successful in later life, but no fierce zeal burns within him. Stimulus must be applied by frequent examinations.

Another point: To check progress frequently is an American habit, and a good one. It enables us to discover faults before they become serious. Frequent checks are particularly important in engineering education. Student years are possibly the most valuable in life. It is unfair to the student to let him continue if he does not belong in the profession. Examinations are one device for disclosing lack of aptitude for engineering.

"The American schools cannot, if they would, put aside their task of personal guidance and social adjustment, their concern for the entire life plan of the student." This is again quoted from the Report of the Investigation of Engineering Education previously mentioned.

May it not be that the German method is best suited to the German purpose in engineering education and that our method is best suited to our purpose? Does not the industrial progress that we have made in this country answer this question in the affirmative?

The Properties of Two Free-Machining Corrosion-Resisting Steels

OF growing importance among the various grades of corrosion-resisting steels is the free-machining type. The ordinary type of free-machining steel, usually referred to as screw stock, has been on the market for a number of years, and full advantage has been taken of its machining qualities. However, it is easily corroded, and this characteristic makes it objectionable for many uses. To overcome this objection, grades of steel have been developed that have all the corrosion-resisting properties of the so-called stainless steels and yet are easily and rapidly machineable.

Two grades of free-machining corrosion-resisting steel known as Bethalon A and B are produced by the Bethlehem Steel Co., Bethlehem, Pa. These steels are of the following analyses:

	Bethalon A, Per Cent	Bethalon B, Per Cent
Carbon	0.11	0.13
Manganese	0.30	0.30
Chromium	13.00	18.00
Molybdenum Sulphide	0.50	0.50
Nickel	Trace	8.00

Resistance to Corrosion

Bethalon A possesses all the high corrosion resistance of the regular carbon-chromium irons, while Bethalon B shows all the inherent properties of its parent alloy, the well-known 18-8 stainless steel. Some of the agents to which Bethalon A is resistant are as follows: Alcohol, benzol, blood, boric acid, carbonic acid, oleic acid, nitric acid, lime, ink, Lysol, magnesium carbonate, Novocaine, mercury, potassium cyanide, potassium oxalate, salt water, sodium salicylate, soft soap, sugar, steam, and silver bromide. In addition to the foregoing agents, Bethalon B resists acetic acid, alum, aluminum sulphate, calcium chloride, carbolic acid, citric acid, cellulose, fruit juices, ferrous sulphate, milk, magnesium sulphate, potassium carbonate, potassium nitrate, tanning liquor, yeast, and zinc nitrate.

Physical Properties of Bethalon Steels

The physical properties of these steels in the condition in which they are generally used are as follows:

	Bethalon A	Bethalon B
Yield point, lbs. per sq. in.	43,000	57,000
Tensile strength, lbs. per sq. inch	74,000	95,000
Elongation in 2 inches, per cent	30.0	35.0
Reduction of area, per cent	50.0	45.0
Brinell hardness number	156	152
Coefficient of linear expansion:		
36 to 100 degrees C.	0.0000109	
36 to 1000 degrees C.	0.0000136	
36 to 200 degrees C.		0.0000175
36 to 500 degrees C.		0.0000186

A feature of the A type free-machining steels is that they can be hardened by quenching in oil at from 1750 to 1850 degrees F., and then tempered to suit the purpose for which they are intended. The chart shows the proper drawing temperature to be used for obtaining various degrees of hardness as indicated by Brinell instruments. The physical properties obtained with the various drawing temperatures are also indicated in this chart. It will be noted that drawing temperatures up to 1000 degrees F. do not decrease either the tensile strength or the elastic limit appreciably.

Bethalon A can be turned, drilled, bored, or threaded just as easily as regular carbon screw stock, using the same tool set-up and the same speed, feed, and depth of cut. Threading can be

Typical Parts Machined from Bethalon Free-machining Corrosion-resisting Steels

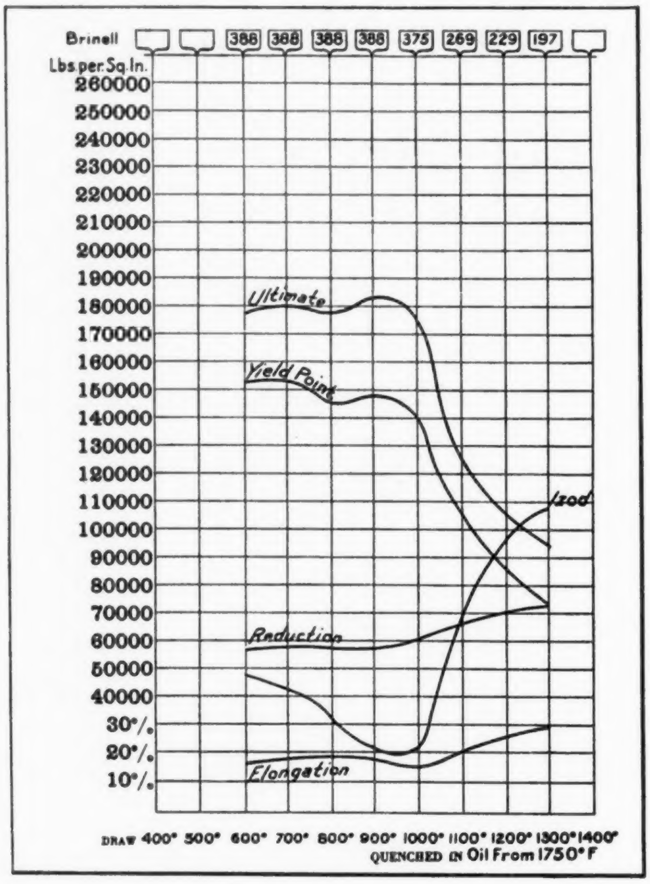


Chart that Indicates the Temperatures Necessary to Draw Bethalon Steels to Various Brinell Hardness Numbers

accomplished at speeds of 150 to 175 surface feet per minute, and smooth turning can be accomplished at the rate of 200 surface feet per minute. This material is also easily ground and polished to a bright luster.

By way of comparison, the power required to remove a cubic inch of the following materials per minute with a planer tool was measured: Ordinary screw stock, 0.745 H.P.; Bethalon A, 0.754 H.P., and stainless chromium iron, 0.961 H.P.

These figures are based on the use of a planer tool 1/2 inch wide, taking a 0.010 inch depth of cut at a speed of 20 feet a minute.

Bethalon B is not quite so machineable as the A grade, but it can be machined at speeds up to 80 or 90 surface feet a minute without too frequent regrinding of tools. This speed is considerably greater than is possible on the 18-8 stainless steel.

Threaded parts of the regular stainless steels have a tendency to freeze when screwed together. With Bethalon A and B, however, the high molybdenum-sulphide content imparts a more or less self-lubricating characteristic, so that threaded parts can be screwed or unscrewed without effort. A micrometer made of Bethalon has been in service for over four years and the working parts can still be moved with ease.

Both Bethalon A and B can be forged without difficulty under definite temperature regulations.

Uses for which these Steels are Adaptable

These free-machining corrosion-resisting steels are particularly well adapted for such parts as screw machine products, bolts, nuts, calculating machine parts, dairy equipment, gears, golf club heads, high-grade instruments, such as micrometers, pump shafts and rods, spark plugs, temperature control instrument parts, and valve parts.

Bethalon A and B are available in the form of annealed bars; ground bars, 1/4 inch to 4 inches round; cold-drawn rods; heat-treated bars; forging billets; drop-forgings; press forgings; wire rods; and wire.

* * *

Determining Inherent Stresses in Large Castings and Forgings

In designing large machines having highly stressed parts, where the dimensions and materials must conform to definite standards within close limits, a knowledge of the magnitude and direction of the stresses existing in the castings and forgings employed is of considerable importance. The entirely new characteristics of some of the new alloys now used in constructing machines of this kind make the problem of stress determination one of increasing importance.

The results derived from a large number of tests reveal the very complicated nature of the stresses often encountered, namely, peripheral stresses, stresses extending in a spiral direction along the outer layers of a solid cylinder, radial and axial stresses, or stresses at an angle to the axis of the specimen. These various stresses may be present singly or simultaneously and may vary in nature and magnitude at different points. Consequently, it is important to the designer to be able to ascertain the magnitude and direction of the stresses.

With the object of obtaining this needed information, the Allgemeine Elektricitäts-Gesellschaft, Friedrich Karl-Ufer 2-4, Berlin, N.W. 40, has developed a method of testing cylindrical specimens. For carrying out the tests, bands of varying width and depth are machined in the cylindrical specimen, so that layers of the material containing the stresses are removed. The stresses remaining in the unmachined portions produce slight alterations in the shape, size, and position of these parts of the test specimen, which are observed by the aid of precision measuring equipment. The differences recorded before and after machining permit some conclusion to be drawn as to the nature, direction, and intensity of the stresses in the test specimen. By computing the average results of several tests on similar specimens, fairly accurate conclusions can be drawn as to the stresses that are to be expected in parts of similar design.

Nickel Cast Iron Multiplies Life of Coke-Crusher Segments

The use of "Ni-Hard" cast iron containing 4.5 per cent nickel and 1.5 per cent chromium for coke-crusher segments and similar applications involving severe abrasion, has made it possible for the Robins Conveying Belt Co., New York City, to greatly increase the life of crusher segments. According to H. Von Thaden, vice-president of the Robins company, 60,000 tons of coke crushed is considered unusually good production for the life of a set of regular chilled-iron crusher rolls.

As compared with this, a user of segments made from "Ni-Hard" cast iron states that these have already crushed over 200,000 tons of coke and that they are still standing up and show comparatively slight wear. In fact, the appearance of the crusher segments indicates that their total life will be approximately 400,000 tons of crushed coke. These rolls are 34 inches in diameter with a 36-inch face. A Brinell hardness of over 700 is regularly obtained on the wearing surfaces, which explains the unusual service record made by the "Ni-Hard" cast iron. This material has also proved of great advantage for many other parts demanding high hardness and wear resistance.

* * *

Basic Laws of Economics

"Economic systems, with their good and evil, are wholly man-made," says Donald Richberg. This is true and may account for the fact that those tried so far have not worked wholly to satisfaction. But just as there are natural laws upon which engineering designs depend for their success, so are there probably natural laws in economics; and the success of the man-made systems depends upon their compliance with these natural laws. They are not wholly undiscovered, but very little account has been taken of them in devising economic systems. Nicholas Murray Butler, president of Columbia University, in an address some time ago, advised those interested in fundamental economic laws to study the principles laid down by Henry George more than fifty years ago.

* * *

New Acid-Proof Cement

A new acid-proof cement that may find application in many places in the metal-working industries has been developed by the Technical Products Co., Pittsburgh, Pa. Corrosion by acids and their fumes has been a serious problem, and in many instances, the old type of wooden tanks, floors, etc., are still used because no acid-proof cement has been available that could be used like ordinary Portland cement. The new cement, it is said, will harden in thirty-six hours into a porcelain-like structure that resists water and many acid solvents.

Tests on the Wear Resistance of Cemented Carbide

Some interesting tests were recently conducted by the Carboloy Co., Detroit, Mich., to determine the relative life of Carboloy cemented carbide under conditions of extreme abrasive wear. Five bars were tested: One made from Carboloy, one from chromium-plated steel, one from nitrided steel, one from bronze, and one from steel having a hardness of 65 Rockwell C.

The chromium-plated bar was plated to a depth of 0.010 inch on each side. This bar is designated *A* in the accompanying illustration. The nitrided steel, 950 to 1050 Vickers B.H., hardened to a depth of 0.020 inch on each side, is designated *B*. The bronze bar shown at *C* had a hardness of 32 Rockwell C. The 65 Rockwell C steel bar is shown at *D*. The Carboloy bar, 92.5 Rockwell A, is shown at *E*.

The method of testing was as follows: The five bars were blasted continuously, using No. 72 steel shot at 100 pounds pressure. This test was continued for forty minutes. After twenty-four minutes, the chromium-plated bar was completely severed; the nitrided bar was worn through after 23 1/2 minutes; the bronze bar lasted 11 1/4 minutes; the 65 Rockwell C steel bar stood up for 40 minutes without being severed, but about 50 per cent of its thickness was worn away. The Carboloy bar showed no appreciable wear, although its surface finish was slightly dulled.

Bars of Different Materials Subjected to Abrasive Wear Tests—A Carboloy Bar is Shown at the Extreme Right

These tests indicate the suitability of cemented carbide for wear-resistant parts, as, for example, for gages, centerless grinder rests, wire guides, sizing punches, electrical contacts, etc.

* * *

To one who cannot read a blueprint, the vagueness of the print does not affect its appearance; and so, the vagueness of many of the current economic proposals does not trouble one who does not understand economics.

The Barber-Colman Tapered Hob-Spindle

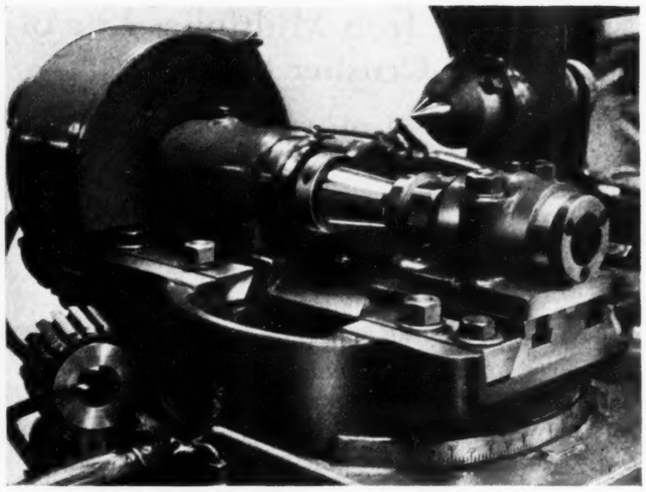


Fig. 2. Tapered Hob-spindle in Place on a Hobbing Machine

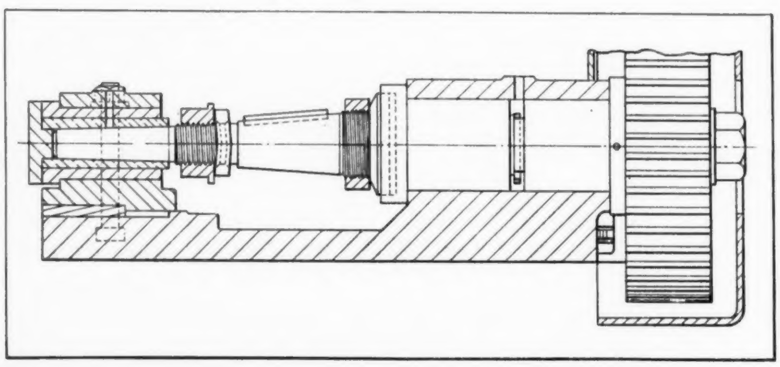
IN the spring of 1931, the Barber-Colman Co., Rockford, Ill., began to investigate the question as to how hobs might be made to run more accurately in hobbing machines. There was an insistent demand for a more accurately running hob, because of the demand for quieter gears. It was found that a very slight run-out in the hob produced an objectionable error in the tooth contour.

The prevailing method of truing up hobs by hammering with a hammer and a piece of brass was crude, uncertain, and slow, and there was danger of damaging the hob and the hob-spindle bearings. There was also danger that as soon as the hob struck the work, it would jar back to its original position.

Furthermore, any irregularities in the parallelism of the spacing washers or any dirt between them would result in bending the arbor when the hob-spindle nut was tightened. Investigation showed that hobs were never trued up in production shops as accurately as they ought to be. If the operator came within 0.001 inch or so, he was quite satisfied, as it was impossible to check back after the hob had been once loosened or removed.

Recognizing the objections to be overcome, it was decided to make a hob-spindle, as shown in Fig. 1, in which the hob would have a tapered hole and an equalizing washer, so that bending strains would be avoided as far as possible. A nut was included on the large end of the spindle, so that the hob could be easily removed without being driven off. A specially shaped nut was provided, so that the operator had to use the wrench that was also provided. This wrench was of the socket type, having a cross-handle at the end, which prevented putting a wrench on the nut and using a hammer, as is so often done. A tapered outboard support was also provided. A taper of 2 inches per foot for the hole in the hob was decided upon as being sufficiently steep to prevent the hob from sticking tightly, and yet not too great to permit accurate centering of the hob.

Fig. 1. Design of Tapered Hob-spindle Developed by the Barber-Colman Co.



Results Obtained by the Hob-Spindle

After the sample hob-spindle and hob had been made, it was found that the object had been attained. A hob so made could be slipped into position with the maximum run-out of 0.0003 inch, and an average run-out of from 0.0001 to 0.0002 inch. Some of this run-out, in fact, would be in the spindle itself, and would be unavoidable on account of the oil-film clearance required. Up to the present time, some twenty-five machines furnished with this type of hob-spindle have been manufactured and supplied to industry. The absence of complaints indicates that the design has proved satisfactory.

Incidentally, the accurate manufacture of the hob is greatly simplified by this construction, as the hob can be put on and off a taper arbor while being made, with the assurance that it will run the same each time. Another advantage is that the diameter of the hole does not need to be held to close dimensions, the only requirement being that the taper be accurate. This eliminates a serious source of loss and trouble in the manufacture of hobs.

One objection raised to the tapered hob-spindle is that a larger diameter hob is required, making it more expensive. The answer to this is that although the hob is more expensive, it has a longer

life, owing to the fact that it nas more cutting teeth, and on a gears-per-hob basis, it is probably cheaper than a smaller diameter hob.

Another objection is that the hole in the hob and the seating portion of the spindle must be kept exceedingly clean when the hob is put in place. While this is true, it must be conceded that, in view of the accuracy required in present-day manufacture, it is not too much to ask that the operator use some care in this respect.

Another objection raised is that the hobs may be split open by being pulled too tightly on the arbor. The most obvious answer to this is that during the entire time that these hob-spindles and hobs have been manufactured, there has been no case of splitting. It is not necessary to pull the nut up very tightly—just sufficiently to seat the hob firmly in place. The type of wrench used prevents overtightening, unless the operator should use some auxiliary means, such as a piece of pipe, on the end of the hob wrench. Experiments to determine the pressure required to split a hob indicate that a pressure of from 20 to 32 tons is necessary to burst a 4-inch diameter 8-pitch hob having a hole 1 7/8 inches in diameter at the large end.

A hob of the construction shown forms a metallic contact with the hob-spindle, which cannot be obtained with a straight-hole design. The spindle itself is many times stiffer than the conventional type, and hence is less subject to bending or warpage.

In working out this design, the Barber-Colman Co. considered other methods, one of which was the use of a sliding sleeve on the outer end of the spindle and a hob having a double-opposed taper. This design was not used because it was felt that a sliding sleeve having a straight hole in it would bring back the very condition to be avoided, and the result might be that one end of the hob would run perfectly true, while the other end would be at the mercy of whatever fit would be obtainable for this sliding sleeve, which fit might be no better than that now obtained by a straight-hole hob and the regular hob-spindle.

* * *

Film on Welding Available for Use

The Linde Air Products Co., 30 E. 42nd St., New York City, announces that the company has a new motion picture illustrating pipe-line welding available for industrial and school showings. The film is entitled "The Multi-flame Lindewelding Head." It has been filmed for the most part in the midwest pipe-line fields. Apart from its general interest, the film should be of great value in showing operators and students correct welding technique. The film is available in the 16-millimeter size, and will be furnished free of charge to industrial groups, schools, and similar organizations, upon application to the company.

Early Electric Cranes

By C. M. CONRADSON, Green Bay, Wis.

On page 96 of October, 1934, MACHINERY, under the heading "Electric Crane Forty Years Old Still in Service," the statement pertaining to the first three-motored crane is in error. The item referred to states: "Up to that time electric cranes had been operated by a combination of manual and electric means. The three-motored electric cranes were something new."

The writer believes that it should be recorded that the first electric crane built in the United States was made by the Edward P. Allis Co. of Milwaukee in its Reliance shop to the designs of Alton J. Shaw, who was employed by that company. This was a 20-ton crane, rebuilt from the available parts of a 20-ton Yale & Towne rope-driven crane. It was a three-motored crane with individual controls for each motor. It was built in 1888 and was very successful. The next electric crane was of similar design, built for the Williams Engine Co. of Beloit, Wis., and was also made by the Allis company.

To Mr. Shaw is due the distinction of building the first three-motored crane in America. Electric cranes were in use in Europe, however, and had been for some years. The Creuzot Works were using electric jib cranes in the early eighties. There was also about that time a short description in *Engineering* of an electric traveling crane built in England. The statement was made that three motors had been considered, but that the crane, as built, had but one motor, with mechanical connections to the various motions. This crane was built before Shaw designed his 20-ton crane. He did not know, however, of the other electric cranes when he developed his design. It is thought that these facts ought to be recorded in the interest of historical accuracy and to do justice to an able engineer.

* * *

The German Machine Tool Industry

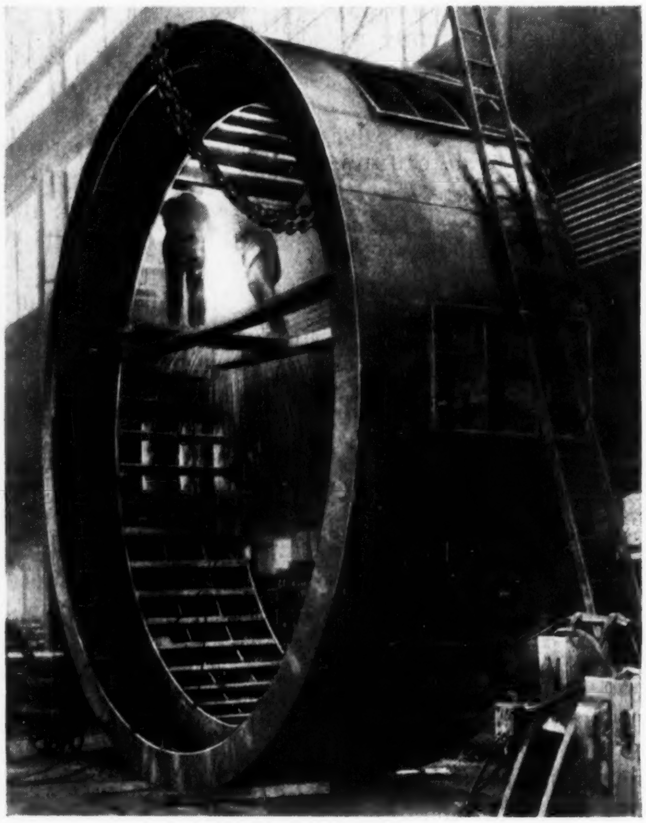
According to the Machinery Division of the Bureau of Foreign and Domestic Commerce, James H. Wright, American Vice-consul, Cologne, Germany, reports an upward trend in German machine tool production since the beginning of 1933. Part of the business is due to the general up turn in industry and part is due to the exemption from taxation granted firms on purchases of new equipment. It is reported that, in some branches of the industry, the sales volume has risen as much as 80 per cent since the beginning of 1933.

The export business, however, has fallen off. The total exports of the German metal-working machinery industry during the first ten months of 1934 amounted to $28,000,000 as compared with $46,000,000 during the corresponding period in 1933, based on the present exchange of 40 cents to the mark.

Open-House Day of the Allis-Chalmers Co.

Recently the Allis-Chalmers Mfg. Co., Milwaukee, Wis., invited thousands of engineers and mechanical executives to an "open house," at which time General Otto H. Falk, chairman of the board, and Max W. Babb, president of the company, were hosts at the main works at West Allis to more than 30,000 guests. These included, in addition to industrialists from all over the central western states, students in technical educational institutions, as well as employes of the company and their families.

In inspecting the plants, the chief attraction was, possibly, the huge 115,000-horsepower hydraulic turbines for Boulder Dam, said to be the largest ever designed and manufactured; but hundreds of other products of the company were also on display in the eight major departments of the company's plant. From the smallest Texrope drive, weighing a fraction of a pound, to the huge steam turbine for Port Washington, Wis., weighing 860 tons, and from farm tillage tools to flour milling machinery, the company displayed its lines applicable to almost every industry.



An Example of the Application of Welding to a 40,000 K.W. Vertical Water-wheel Driven Generator at the Allis-Chalmers Plant

Among the unusual equipment used in the plant in the manufacturing processes that were shown to the visitors was a periscope similar to those used on submarines, which is employed for examining the interior of forgings to discover defects in the metal. The large boring mill installed not long ago in one of the company's shops, which is the largest in America, attracted a great deal of attention. On this boring mill, castings up to 40 feet 4 inches in diameter and 16 feet high, can be bored and turned. (This boring mill was illustrated in the July, 1934, number of MACHINERY, page 657.)

Another interesting piece of equipment seen for the first time by most of the visitors was an enormous casting washing machine, which consists of a large concrete vault in which the castings are placed on a revolving table. Water at a pressure of 450 pounds per square inch plays upon the castings from several nozzles, forcing the sand and cores from the castings.

Among the outstanding products of the company shown to the visitors, apart from the Boulder Dam turbines, were the electrical switch gear for the Boulder Dam power plant; the large roller gates for controlling navigation and floods in the upper Mississippi River; and crushers of a size to take 25-ton pieces of rock, crushing them at the rate of 1000 tons an hour. An interesting demonstration was also given of man-made lightning with a 2,000,000-volt current.

* * *

Individuals hesitate to make purchases—unless absolutely required for current living—if they lack confidence in the future. What is true of individuals is just as true of business enterprises. A statement by the Government of its intentions would help to create confidence. If the Government is known to be trying to protect the possessions of its citizens, they are encouraged to purchase things that have a permanent value; but if the Government is thought to be uninterested in the protection of the possessions of individuals, the individual is discouraged from making such investments, and the manufacturers of such permanent possessions cannot find a market. — *George P. Torrence, President, Link-Belt Co., in Link-Belt News*

* * *

There is much talk today of "made" employment and of "made" money. There are grave doubts in the minds of many as to the efficacy of those; but there should be no doubt regarding the lack of efficacy of "made" credit. The almost inevitable after effects of attempting to make or create or bestow credit will be an undermining not only of the principles upon which sound business must rest, but of those upon which the procuring of the necessities and comforts of life must depend.—*David A. Weir, of the National Association of Credit Men, in Commerce and Finance*

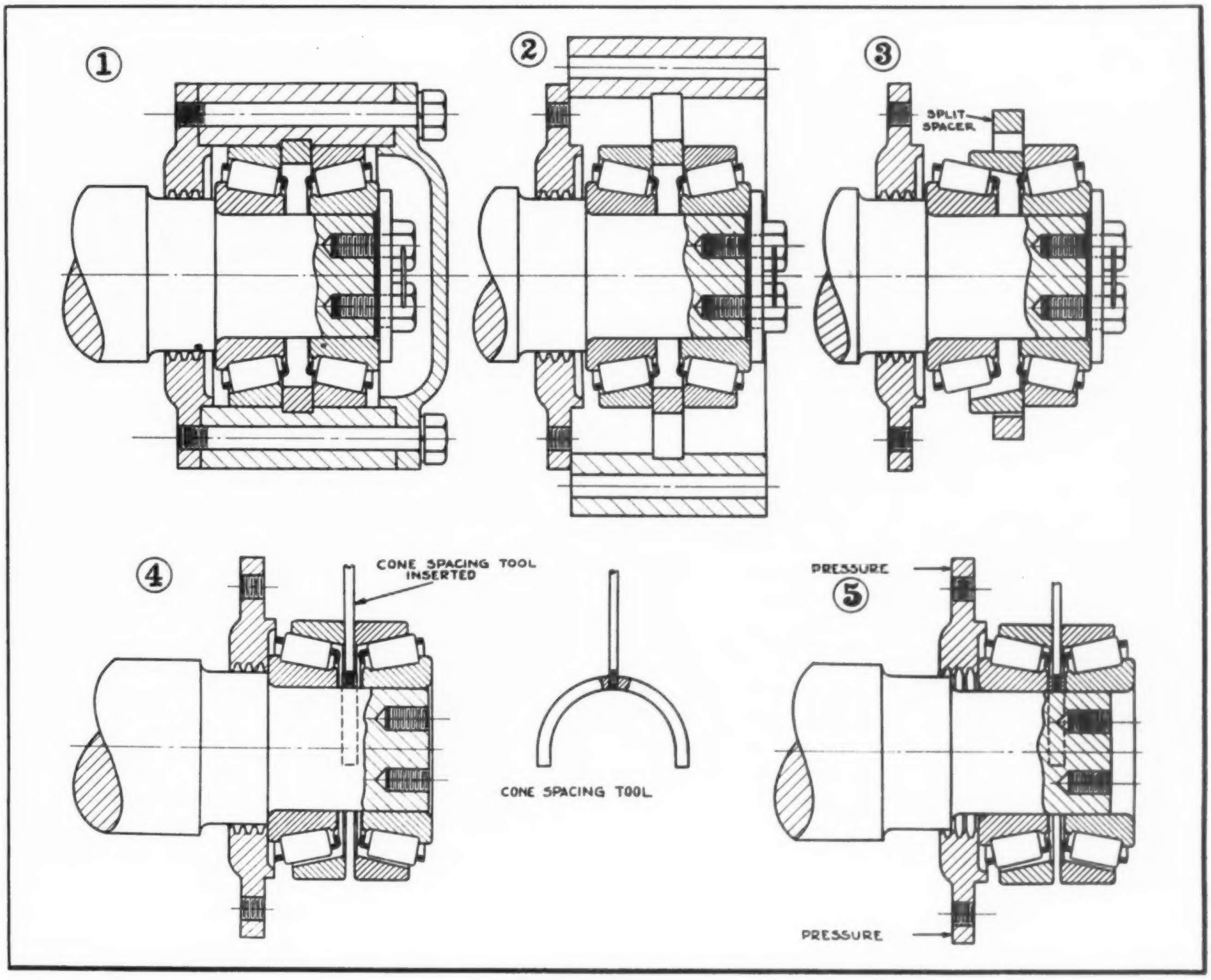
Removing Roller Bearings from Split Housing Assemblies

Tapered roller bearings are designed to take side thrust loads, in addition to radial loads. Consequently, if pressure is applied to the cups in removing a bearing of this type, a radial pressure results, which makes it more difficult to slide the cone off the shaft. The Timken Roller Bearing Co., Canton, Ohio, recommends that pressure be applied only to the cones when a bearing is to be removed from a shaft. The accompanying diagrams illustrate the proper method of removing Timken bearings from split housings.

In Fig. 1 is shown a double bearing mounted in a fixed manner, as contrasted with a floating application. The two bearings are located in this assembly by means of a split spacer ring which fits into a recess in the base and cap of the housing. The inner bearing cone is located by a shoulder on the shaft. Metal shims are provided between the end plate and the end of the shaft.

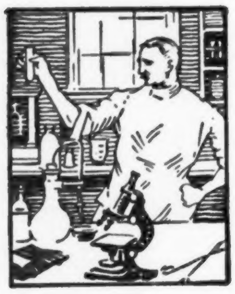
The first step in removing the bearings from such a mounting is to unscrew the through bolts, so as to release the cover plate, the bearing cap, and the bearing base, as indicated in Fig. 2. The shaft and bearings can then be removed as a unit from the housing, after which the split spacer ring that separates the cups is loosened and taken off. This permits the inner cup to slide down on the rollers sufficiently to be out of the way, as illustrated in Fig. 3, so that pressure can be applied to the inner cone by the inner closure plate.

Now remove the end plate and shims, as in Fig. 4, and insert a cone spacing tool between the two bearings. This appliance must be thin enough so that it can be inserted between the roller cages of both bearings and fitted around the shaft between the cones. Pressure is then applied on the inner closure plate, as indicated in Fig. 5, to start the inner bearing cone along the shaft. The force is transmitted to the outer bearing cone through the cone spacing tool, so that both bearings will slip smoothly off the shaft.



Figs. 1 to 5. Diagrams Showing How to Remove Timken Bearings from Split Housing Assemblies without Damaging Bearings or Shafts

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

High-Speed Steels with Molybdenum an Important Element

Molybdenum is the principal alloying element in a new class of high-speed steels that is being introduced on the market under the trade name "Mo-Max." The use of molybdenum in these high-speed steels allows a substantial reduction in the amount of tungsten necessary. In the group that is now commercially available, there is 8 per cent molybdenum, 2 per cent tungsten, 4 per cent chromium, and 1 per cent vanadium; whereas, in the long established 18-4-1 class of high-speed steels, there is 18 per cent tungsten, 4 per cent chromium, and 1 per cent vanadium. The carbon content in Mo-Max steel is about 0.10 per cent higher than in comparable grades of the 18-4-1 steels.

One of the most important advantages of molybdenum-tungsten high-speed steels is of national significance. Approximately 85 per cent of the world production of molybdenum comes from the United States, and there are ample ore reserves. On the other hand, the United States is dependent upon foreign sources (mainly China) for about 75 per cent of the tungsten used in this country, and approximately that amount is required today in the manufacture of high-speed steel.

The price of tungsten is controlled mainly by the amount of Chinese tungsten available. During the last twenty years the price has fluctuated so widely that industry has been forced to carry large stocks on hand for economic protection. In addition to these factors, there is always the danger of the tungsten supply becoming shut off in the event of war.

With the new class of high-speed steels, the principal alloying element—molybdenum—is a natural resource of this country. Further, the domestic tungsten mining industry is capable of producing enough tungsten to meet all requirements if nothing but molybdenum-tungsten high-speed steel were used.

Molybdenum-tungsten high-speed steel was discovered several years ago by Joseph V. Emmons, metallurgist of the Cleveland Twist Drill Co., Cleveland, Ohio. It is now being manufactured by the following concerns and sold under individual trade names: Crucible Steel Co. of America, New York City; Ludlum Steel Co., Watervliet, N. Y.; Universal Steel Co., Bridgeville, Pa.; Cyclops Steel Co., Inc., Titusville, Pa.; Latrobe Electric Steel Co., Latrobe, Pa.; and Braeburn Alloy Steel Corporation, Braeburn, Pa.

Tools made from Mo-Max high-speed steel normally exhibit greater hardness than those made of the 18-4-1 group of high-speed steels, and at the same time they have equal or greater toughness. On regular production work, the performance of tools made of the new steel is scarcely distinguishable from that of the older group. However, in some cases, where difficulty has been experienced in machining work with 18-4-1 high-speed steel tools, molybdenum-tungsten high-speed steel tools have shown definite advantages.

A Molded Plastic that Can be Punched and Stamped

Unusual strength is one of the features claimed for Tenite, a thermoplastic molding material that is made from cellulose acetate by the Tennessee Eastman Corporation, Kingsport, Tenn. Because of the strength of this material, holes and slots can be readily punched in parts without danger of fracturing the material. To obtain the best results, thin-walled sections should be warmed to a temperature of not over 140 degrees F., while somewhat more heat can be applied to parts of thicker section. Holes and slots can, of course, be molded in the material as well, but sometimes this method necessitates an expensive mold.

Trademarks, decorative designs, etc., can be conveniently stamped on Tenite parts. This feature enables parts of the same shape, but that are to be trademarked differently, to be produced in the same molds. The material can also be drilled and otherwise machined with ease.

Tenite is supplied both in molding sheet and granular form. The granulated material is most suitable for use in molds having a narrow cross-section and a deep cavity, whereas blanks cut from sheets are best suited to the formation of thin ar-

ticles in shallow cavities. A piece molded from the sheet material is stronger than one molded from granulations.

In molding parts from a sheet, the material flows into the depressions of the mold with the application of heat and pressure. The molding temperature ranges from 280 to 340 degrees F., depending upon whether the material is of soft or hard grade. Usually a pressure of 2000 pounds per square inch is sufficient for open molds.

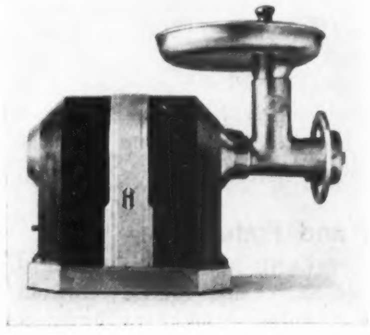
Tenite is available in all colors, both plain and variegated, and in all degrees of translucency from crystal clear to opaque. Molding blanks and sheets are produced in thicknesses of from 3/16 to 1 inch and in pieces as large as 20 by 25 inches. The material is immune to vegetable or mineral oils, but essential oils and alcohol are partial solvents and will soften or spot the surface of a molded piece. Tenite should not be subjected to acids or alkalies having a strength in excess of 1/2 per cent. Parts molded from the material are unaffected by temperatures up to about 160 degrees F. It does not burn readily, being about the same in this respect as hard rubber, fiber, or wood.

Artistic Meat Chopper Produced by Applying Modern Materials

Materials of various kinds are being combined to obtain pleasing designs of machines and mechanical appliances. As an example of this tendency in industry, attention is called to the attractive meat chopper here illustrated, which is a product of the Hobart Mfg. Co., Troy, Ohio. Black and silver are featured in the color scheme, the black portion of the housing being made of Bakelite.

The metal of the housing is made from the nickel-iron alloy known as "Ni-Resist" which, being much denser than ordinary cast iron, takes a very high polish. Chromium-plating makes the metal surfaces practically rustproof.

Ni-Resist alloy has the following approximate composition: Nickel, 18 per cent; copper, 7 per cent; chromium, 1 per cent; silicon, 2.5 per cent; manganese, 0.5 per cent; phosphorous, 0.18 per cent; sulphur, 0.06 per cent; combined carbon, 0.34 per cent; and graphitic carbon, 2.36 per cent.



Several of the Newer Materials—Ni-Resist Alloy, Stainless Steel, Die-Cast Aluminum, and Bakelite—are Represented in this Modern Meat Chopper

Stainless steel is used for the cutting parts of the meat chopper. The black handle which projects above the feed pan is an aluminum die-casting with a black anodic finish. The feed pan itself is of drawn steel, satin finished and chromium-plated. The lower part of the so-called "pusher" is a cup of drawn stainless steel.

Stainless Steel Electric Train for New York's Subways

An acceleration of five miles an hour per second is claimed for a five-section train of stainless steel, recently added to the transportation equipment of the Brooklyn-Manhattan Transit Corporation, New York City. This train weighs only about 250 pounds per passenger, or a total of 159,000 pounds, whereas a comparable train built according to conventional standards would weigh at least 325,000 pounds.

It is pointed out in *Nickel Steel Topics*, published by the International Nickel Co., 67 Wall St., New York City, that light weight has been obtained in this train without sacrifice of strength, through the use of 18-8 chromium-nickel steel having a tensile strength of 150,000 pounds per square inch. This material was used in sheets as thin as 0.010 inch and few sections were more than 0.050 inch thick. The train was fabricated by the Shotweld method of the Edward G. Budd Mfg. Co.

A New Sheet and Plate Steel of High Tensile Strength

A minimum yield point of 70,000 pounds per square inch and a minimum tensile strength of 90,000 pounds per square inch, are claimed for a new sheet and plate steel recently brought out by the Alan Wood Steel Co., Conshohocken, Pa. From these high physical properties the trade name of "A. W. 70-90" has been derived. The guaranteed minimum elongation of the new steel is 20 per cent in 2 inches.

This new sheet and plate steel can be arc, fusion, or hand welded as readily as soft steel. It possesses the advantage of not requiring an annealing operation to overcome brittleness adjacent to the weld line. Although the steel has greater stiffness than normal sheet steel, it can be formed cold and even bent back 180 degrees. The elements added to "70-90" steel give it far greater ability to resist atmospheric corrosion than is possessed by ordinary sheet steel. This feature permits the use of lighter sections.

NEW TRADE  LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies can be Obtained by Writing Directly to the Manufacturer.

Carboloy Tools

CARBOLOY CO., INC., 2987 E. Jefferson Ave., Detroit, Mich. Booklet SC-35, entitled "The Profitable Use of Carboloy Cemented Carbides," containing complete information on Carboloy tools. The booklet covers the advantages obtained through the use of these tools, equipment required for using them, operations for which they are suitable, types of tools tipped with Carboloy, materials that can be profitably machined, methods of purchasing Carboloy cemented carbide, size of plants that can use Carboloy profitably, physical characteristics, applications, grinding of Carboloy tools, operation and design recommendations, and information on how Carboloy tools are made.

Tools and Tool-Holders

ARMSTRONG BROS. TOOL CO., 313 N. Francisco Ave., Chicago, Ill. General Catalogue B-35, containing seventy pages covering the complete line of tools and tool-holders made by this concern. Thirty-five new lines or additions are announced in this catalogue. Among others may be mentioned a line of permanent multi-purpose tools for turret lathes and screw machines that take standard-shaped cutter bits; a line of chrome-vanadium steel detachable-head socket wrenches and wrench sets with a new "drivelock" feature; a line of carbide cutters and tool-holders; and a line of receding type pipe threaders.

Electric Equipment

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis. Booklet commemorating the eighty-eighth anniversary of the founding of the concern. The booklet represents a tour of the Allis-Chalmers plant, the reader being taken through the various departments and shown the many different lines of equipment made by the company, which include farm and industrial tractors and machinery, flour and cereal mill machinery, engines and condensers, electric motors, transformers, power transmission machinery, boring mills, centrifugal pumps, hydraulic and steam turbines, electrical equipment, etc.

Industrial Equipment

L. O. KOVEN & BRO., INC., 137 Ogden Ave., Jersey City, N. J. New 52-page catalogue outlining in detail the services rendered by this company to the industrial field. This catalogue covers a wide range of plate and sheet metal construction as follows: Tanks for process and storage; equipment for the chemical and allied industries; mixers; equipment for food industries; equipment for machinery, metal product plants, public utilities, railroads, etc.; containers; sinks and tables; chutes, hoppers, piping, stacks, etc.; marine equipment; and built-up welded construction.

Metal-Cutting Tools

ECLIPSE COUNTERBORE CO., Detroit, Mich. Catalogue 35, containing complete data on the Eclipse line of counterbores, milling cutters, and other tools. A number of new developments are shown in the catalogue. Among these are a new radial drive; a 0.001-inch adjustment variable-length holder; a complete line of cemented-carbide tipped turning tools; and solid hollow milling cutters with relieved internal teeth. A special tool section showing many typical Eclipse tool applications is of particular interest to tool and production engineers.

Jigs and Fixtures

CLEVELAND UNIVERSAL JIG CO., 13404 St. Clair Ave., Cleveland, Ohio. Catalogue 35, containing complete information on Cleveland Universal standard products, including cam jigs, cam locks, and angle-plates. Tool and jig designers, tool engineers, and supervisors of tooling equipment will find much useful information in this book. It is provided with a thumb-index for convenient reference, and is published in loose-leaf form so that new matter can be added from time to time in order to keep the catalogue up to date.

Thermostatic Bimetal

GENERAL PLATE CO., 33 Forest St., Attleboro, Mass. Bulletin 301, containing information on Truflex thermostatic bimetal and its application in automatic temperature control. The method of making, types, characteristics, etc., are also described. A useful feature of the book is a series of charts for rapidly calculating the proper bimetal elements to use for different applications.

Small Tools

STANDARD TOOL CO., Cleveland, Ohio. Catalogue 34, containing 320 pages, covering the complete line of small tools made by this company, which includes twist drills, reamers, milling cutters, taps, dies, chucks, taper pins, and special tools. In addition to the details of dimensions, prices, etc., much other informative matter is given that should be useful to users of these tools.

Electric Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Catalogue GEA-612B, containing data on demand meters, designed for the measurement of maximum demand. Bulletin GEA-897E, descriptive of air-cooled transformers for lighting and power service. Bulletin GEA-1305C, illustrating and describing luminous-tube transformers for use with luminous-tube signs.

Small Tools

NATIONAL TWIST DRILL & TOOL CO., INC., Detroit, Mich. Catalogue 15, containing 308 pages covering

the complete line of tools made by this concern, including twist drills, reamers, milling cutters, special tools, and hobs. The sections of the book are printed on different colored paper to facilitate reference. Considerable information of value to the designer is included.

Precision Gages

LANGLOIS GRINDING CO., INC., 1602 Twenty-third St., Detroit, Mich. Catalogue containing data on standard plug, ring, taper, and taper ring gages. The book also contains information on gaging fixtures, master gages, chrome-plated gages, and Langlois metal, a tungsten-carbide material used for tipping gages and other contact points.

Precision Boring Machines

CIMATOOL CO., East Third at June, Dayton, Ohio. Bulletin entitled "Precision Boring—a Modern Necessity," describing the field of application of precision boring, features of construction of Cimatool boring machines, and the three types in which these machines are made, namely, the heavy-duty, the universal, and the normal duty models.

Heat-Treated Forgings

KROPP FORGE CO., 5301 W. Roosevelt Road, Chicago, Ill. Bulletin showing typical examples of heat-treated forgings made by this concern, ranging from small forgings of a pound or two in weight to large forgings weighing many tons. The circular also lists some of the many specification steels that this company has in stock.

Valves

HOMESTEAD VALVE MFG. CO., Coraopolis, Pa. Reference Book 37, describing this company's complete line of valves, including several new products, such as the protected-seat hydraulic operating valve and the protected-seat spray valve used in the control of high-pressure hydraulic spray systems for descaling steel.

Bakelite Varnish, Enamel, etc.

BAKELITE CORPORATION, Bound Brook, N. J. Booklet dealing with four classes of Bakelite products, namely, varnish, enamel, lacquer, and cement. The booklet describes in detail the characteristics, uses, and technique involved in handling these materials, all of which require baking to bring out their best properties.

Stainless Steel

REPUBLIC STEEL CORPORATION, Massillon, Ohio. Bulletin containing data on the various types of Enduro 18-8 stainless steels. An interesting feature of the catalogue is a table showing the degree of corrosion resistance possessed by these various steels when subjected to several hundred chemicals and acids.

Grinding Wheels

NORTON CO., Worcester, Mass. Booklet (Form 507) telling the story of "Diamonds in Grinding Wheels." The booklet describes the field for Norton diamond wheels, tells how to use these wheels for grinding and lapping the cemented carbides and hard, brittle materials, and gives a list of available sizes.

Drafting Supplies

WADE INSTRUMENT CO., 2274 Brooklyn Station, Cleveland, Ohio. Circular announcing the line of drafting instruments and supplies carried by this concern, which includes beam compasses, a new isometric lined sketch paper, perspective sketch paper, pantographs, and automatic irregular curves.

Lighting Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Leaflet 3200, describing the advantageous features and the field of application of the portable Novalux flood-lights, which are made in three types, known as the "Junior Handy," "Senior Handy," and "Exposition Handy."

Precision Boring Machines

STOKERUNIT CORPORATION, 5325 W. Rogers St., Milwaukee, Wis. Bulletin describing the advantages, operation, and construction of the Simplex precision boring machines, which are designed for the economical precision boring of all metals with tungsten-carbide or diamond tools.

Welding Equipment

LINCOLN ELECTRIC CO., Cleveland, Ohio. Application Sheet No. 41, in a series on the use of welded parts in machine construction, dealing with welded-steel machinery bases. The circular shows typical designs of cast-iron and welded-steel bases and gives figures on comparative costs.

Tubes and Pipes

YOUNGSTOWN SHEET & TUBE CO., Youngstown, Ohio. Booklet 18, entitled "Matched Thread Perfection," illustrating and describing, step by step, the methods and equipment used in producing the perfectly matched threads on mating couplings and pipe made by this concern.

Air Compressors and Gas Engines

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Circular L-611-B3, descriptive of Worthington steam booster compressors. Bulletin S-550-B3A, describing Worthington vertical four-cycle gas engines.

Diamond Dressing Tools

KOEBEL DIAMOND TOOL CO., 1220 Oakman Blvd., Detroit, Mich. Pamphlet entitled "A First Reader for Diamond Users," containing a few simple facts, in primer form, relating to the advantages of Koebel multi-point, multi-set and multi-edge diamond dressing tools.

Chucks

JACOBS MFG. CO., Hartford, Conn. Bulletin containing tables of dimensions and prices of the different models of Jacobs chucks, many of which are interchangeable. Directions are included for fitting the chucks to various machine spindles.

Gears

MEISEL PRESS MFG. CO., 948 Dorchester Ave., Boston, Mass. Booklet entitled "Gear Craftsmanship," containing an outline of the historical progress of the concern, as well as technical information on the production of high quality gears.

Automatic Timers

WALSER AUTOMATIC TIMER CO., Chrysler Bldg., New York City. Catalogue treating of the automatic timing of electrical appliances with Walser automatic timers, which are applicable to the shop, factory, laboratory, office, and household.

Hardening Process

WESLEY STEEL TREATING CO., 1333 W. Pierce St., Milwaukee, Wis. Circular outlining the characteristics and applicability of the Chapmanizing process—a method of producing an extremely hard, wear-resistant case on low-carbon steels.

Washers and Stampings

WROUGHT WASHER MFG. CO., 2100 S. Bay St., Milwaukee, Wis. Catalogue entitled "Special Washers

and Stampings," listing over 19,000 tool sets for producing washers and stampings applicable to practically every mechanical product.

Electric Motors

LOUIS ALLIS CO., Milwaukee, Wis. Bulletin 507, describing the Louis Allis line of direct-current motors. Bulletin 510, describing Louis Allis totally enclosed fan-cooled motors. Bulletin 514, describing single-phase capacitor motors.

Electric Furnaces

HEVI DUTY ELECTRIC CO., Milwaukee, Wis. Bulletin HD-135, containing a detailed description, together with specifications, of the standard line of box type electric furnaces made by this concern.

Variable-Speed Transmission

REEVES PULLEY CO., Columbus, Ind. Pamphlet entitled "Inside Facts About Variable Speed Control," briefly describing the operating principle, design, and construction of Reeves variable-speed transmissions.

Turbine Pumps

ROOTS-CONNERSVILLE BLOWER CORPORATION, Connersville, Ind. Bulletin 260-B12 describing the operation and construction of Type T turbine pumps for handling volatile liquids.

Ball and Roller Bearings

BEARINGS INDUSTRY CORPORATION, 1834 Broadway, New York City. Circular illustrating some of the many types of ball and roller bearings made by this concern for a wide variety of purposes.

Heat-Treating Equipment

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Bulletin W-1200-B10, descriptive of Worthington drill steel automatic heat-treating machines and forging furnaces.

Jacks

PIERCE-MILLER & CO., Brazil, Ind. Circular announcing the new Pierce pulling jack—a powerful rugged tool designed for any kind of heavy pulling power where speed is not essential.

Electrode-Holders

CRAFTSWELD EQUIPMENT CORPORATION, 250 W. 54th St., New York City. Circular outlining the features of construction of the new Craftsweld clamp type electrode-holder for welding operations.

Safety Hand Lamps

PYLE-NATIONAL CO., 1334 N. Kostner Ave., Chicago, Ill. Bulletin 190, listing forty-eight types of safety portable hand lamps for general industrial use.

Lift-Truck Platforms

BARRETT-CRAVENS CO., 3255 W. 30th St., Chicago, Ill. Bulletin 252, entitled "Eight Added Values in Barrett Steeleg Platforms for Hand and Power Trucks."

Nails

ANGELL NAIL & CHAPLET CO., 4580 E. 71st St., Cleveland, Ohio. Leaflet containing an analysis of the construction, use, and serviceability of the Angell nail.

Presses

WATERBURY FARREL FOUNDRY & MACHINE CO., Waterbury, Conn. Folder announcing a new line of Waterbury two-post general-purpose presses.

Draw-Cut Machine Tools

MORTON MFG. CO., Muskegon Heights, Mich. Circular illustrating Morton Draw-Cut shapers in actual use on various classes of work.

Cast-Iron Sheaves

DODGE MFG. CORPORATION, Mishawaka, Ind. Circular outlining the advantages of a new line of cast-iron light-duty sheaves.

Business Proceeds at an Accelerated Pace

The automobile industry initiated its 1935 production activities with an output for all American automobile factories of approximately 306,000 cars and trucks in January, according to the Automobile Manufacturers' Association. Only in January, 1926, and in January, 1929, has the production for the month of January in any one year exceeded that for the present year. The production is 87 per cent above that of the corresponding month last year.

The machine tool industry has shown a decided improvement. There was a well distributed demand for machine tools in December, and this demand held up very well during January, with the domestic business showing a slight gain over December. In fact, the domestic business in both December and January reached the highest volume of any month since 1930. The foreign business also expanded during these two months at a better rate than for the previous months in 1934.

According to information collected by the American Iron & Steel Institute, based upon replies to a questionnaire, the steel industry is planning to spend more than $125,000,000 for new equipment and plant modernization during 1935. The new equipment will largely be for the purpose of producing the lighter types of finished steel products.

Orders received by the General Electric Co. during the year 1934 amounted to $183,660,000, as compared with $142,771,000 for 1933—an increase of 29 per cent.

The U. S. Navy has placed orders for thirty large Diesel engines to be installed in five new submarines. The total cost of these engines and the electrical equipment used in connection with them is nearly $4,000,000. The engines are to be furnished by Fairbanks, Morse & Co., Chicago, Ill.

The Carboloy Co., Inc., Detroit, Mich., reports that orders entered in January, 1935, represent an increase of 125 per cent over January 1934.

British Exports and Imports

According to a report by Vice-Consul Myles Standish of Manchester, England, to the Machinery Division of the Bureau of Foreign and Domestic Commerce, the total exports of machinery from Great Britain in 1934 increased by about 19 per cent over those of 1933. Among the principal exports were electrical machinery, machine tools, mining machinery, and textile machinery. The British dominions and colonies absorbed the largest share of the exports of the United Kingdom. The Soviet Union and France were the next most important customers.

The total imports of machinery into the United Kingdom during 1934 exceeded that for 1933 by over 30 per cent. Machine tools and textile machinery were the most significant items among the imports. Forty-three per cent of the total machinery imports of the United Kingdom came from the United States; about 30 per cent came from Germany.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts and Material-Handling Appliances Recently Placed on the Market

Fig. 1. Shaft and Gear with Taper Splines

Barber-Colman Taper-Spline Hobbing Machine

A new method of assembling gears, pulleys, wheels, and similar members on the end of shafts, studs, and axles has recently been developed by the Barber-Colman Co., Rockford, Ill. With this method, taper splines hobbed on the end of the shaft mate with corresponding splines broached in the hub of the part to be mounted on the shaft. Two pieces machined for assembly are shown in Fig. 1.

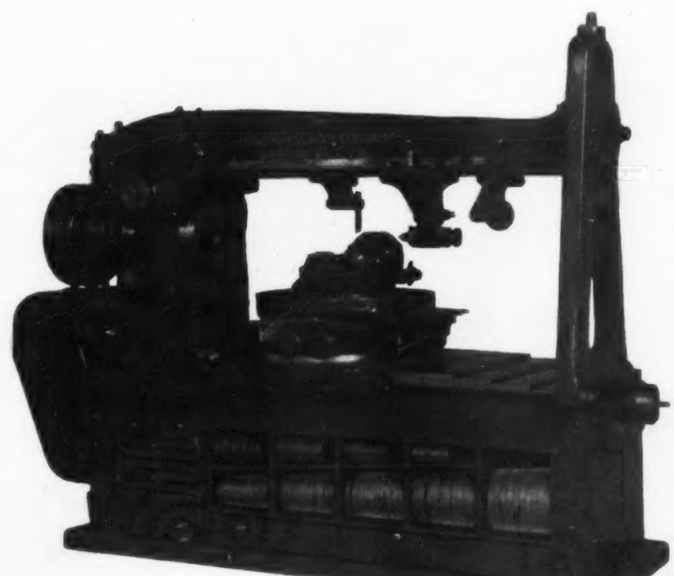


Fig. 2. Machine Designed for Hobbing Barber-Colman Taper Splines, as well as for Standard Hobbing

Unusual strength is one of the important advantages claimed for the taper-spline method of assembly, the construction being three times as strong as when a single key is used. It is also stated that with this method, parts can be positioned on a shaft fully as accurately as with a single key, and more permanently. The cost of providing the taper splines on the two parts is said to be comparable to that of cutting single keyways.

The Barber-Colman taper splines can be hobbed on the ends of shafts and similar members by the Type T hobbing machine shown in Fig. 2, which has recently been designed by the concern. This machine can be used for all kinds of standard hobbing, in addition to the hobbing of taper splines. It resembles the regular Type A machine built by the concern, but has a different hob slide swivel construction, as means had to be provided for traversing the hob not only laterally but longitudinally as well.

In cutting taper splines, a hob of tapered form is employed.

The longest teeth of the hob enter the work first and cut the deepest part of the splines. As the hob moves along the shaft, it also moves across it, so that progressively shorter teeth on the hob cut shallower portions of the splines until the end of the operation is reached. One hob can be employed to produce a variety of tapers on a shaft of given size, but a separate hob is required for each different shaft diameter.

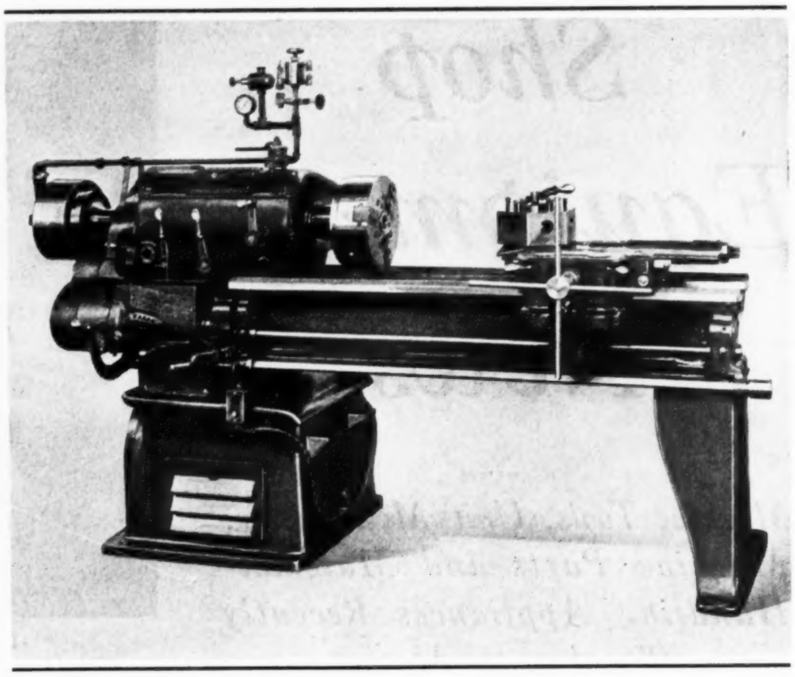
The operating and controlling mechanisms of the machine are somewhat different from those employed on the ordinary hobbing machine. There is an additional feed-screw in the lower hob swivel slide to impart the longitudinal traverse to the hob. Micrometer dials on the work-slide and on the main feed-screw aid in positioning these members accurately for loading. The work is positioned properly by means of a scale on the over-arm and a fixed stop.

The machine is driven by a motor in the base. Automatic stops and safety stops are provided on the two traversing slides. A quick-action tailstock speeds up loading and unloading between cuts. Oil is delivered to all important points by a centralized pressure lubrication system. The bed ways are protected by telescoping plates of heavy construction.

Adjustable Spacer Collars for Milling Operations

Adjustable collars designed to facilitate the accurate spacing of cutters on milling machine arbors when cuts are to be taken in multiple are being placed on the market by the Dayton Rogers Mfg. Co., 1845 E. Franklin Ave., Minneapolis, Minn. These collars are graduated in thousandths of an inch, but adjustments to 0.00025 inch can be easily obtained.

The collars are regularly made in nine sizes for cutter-arbors from 5/8 inch to 2 1/4 inches in diameter, inclusive. Larger sizes can be made special.



Turret Lathe Recently Brought out by the Reed-Prentice Corporation

Reed-Prentice Eight-Speed Turret Lathe

The Reed-Prentice Corporation, Worcester, Mass., has recently developed a "Production Type" turret lathe, equipped with a standard eight-speed sliding-gear headstock. Power is supplied by a self-contained motor drive enclosed in a cabinet leg at the left-hand end of the machine. One of the unusual features of the machine is a power feed for the bed turret in both directions, so that the turret can be fed under power toward and away from the headstock. Various rates of feed for the turret are obtained through a quick-change gear-box.

This turret lathe is intended primarily for the performance of drilling and reaming operations in cast iron. Work up to 12 inches in diameter can be held in the three-jaw air-operated chuck. Opening and closing of the chuck are effected by means of a 10-inch rotating cylinder and an automatic lubrication unit. The machine swing is 14 inches.

Brown & Sharpe Light Type Plain Milling Machine

The latest addition to the line of milling machines built by the Brown & Sharpe Mfg. Co., Providence, R. I., is the light type No. 2 plain machine here illustrated. Contrary to the trend of machine tool design during recent years toward increased size and weight, added horsepower, multiplicity of controls, etc., this new milling machine has been simplified intentionally and is not too heavily proportioned. It is designed for sensitive and easy operation, in combination with accuracy and rigidity.

Except for being of the plain type, the machine is essentially the same as the universal model described fully in May, 1934, MACHINERY, page 561. As on the universal machine, the spindle has been lowered to a height that facilitates seeing the cutters and the work. The cor-

respondingly lower height of the table brings about easier handling. These features are especially desirable with work requiring close observation and frequent handling, as is generally the case with the lighter classes of work.

The machine is completely self-contained, being driven by a flanged-type motor equipped with a pinion that meshes with an internal gear on the main driving shaft. The motor runs only when the machine is in operation. It is started by means of the regular machine starting lever, which also applies a brake for quick stopping. All wiring is enclosed in a compartment, where it is fully protected and at the same time is readily accessible.

Sixteen spindle speeds ranging from 40 to 1300 revolutions per minute are available in two series. Speed changes are made through a rotating lever on the side of the column, in conjunction with back-gear and high- and low-series levers. There is a convenient single-lever feed control for obtaining sixteen feeds ranging from 1/2 to 18 1/4 inches a minute. All feeds can be disengaged by placing the feed-lever in a locked position. This will prevent accidental engagement of feeds when they are not required, as in the performance of drilling and boring operations. The direction of the longitudinal feed is governed from the front of the table, while transverse and vertical feeds are controlled through levers on the knee.

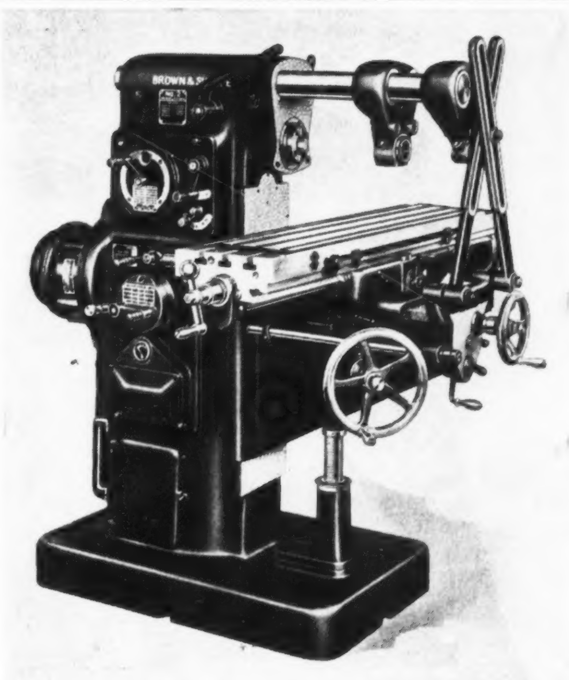
The column differs from the conventional design in that the face on which the knee rests is set back approximately 4 inches from the front end of the spindle. This gives added clearance for vises, fixtures, and work, especially when using end-mills, and also permits cutters to be set close to the spindle nose.

The different attachments mentioned in the description of the universal machine can also be supplied for the plain type, and a coolant system can be provided. The machine has a longitudinal feed of 28 inches, a transverse feed of 10 inches, and a vertical feed of 15 inches. The net weight is approximately 2400 pounds.

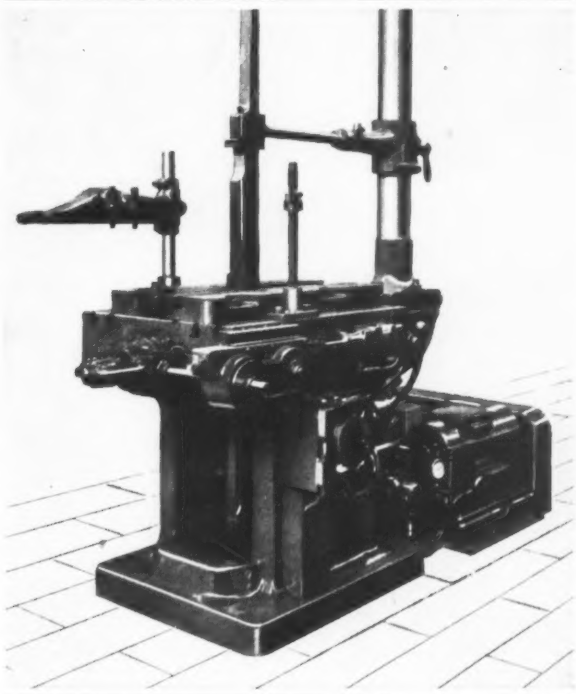
Morton Stationary Keyway-Cutter and Slotting Machine

In a new keyway-cutter and slotting machine recently built by the Morton Mfg. Co., Muskegon Heights, Mich., the work remains stationary and adjustments for taper, depth of cut, and keyway cutting in taper bores are made by means of the guides, cross-head, and cutter-bar member. This machine, as shown in the illustration, consists primarily of four major units—a top plate, a guide and cross-head unit, a column, and a driving unit.

An auxiliary top plate is furnished on the main top plate as a protection in handling heavy work. Jaws provide for centering bores of all diameters with a minimum amount of equipment. A bracket bolted to the front of the top plate contains a nut and screw mechanism for



B & S Plain No. 2 Milling Machine of Light, Simplified Design



Morton Stationary Keyway-cutter and Slotting Machine

feeding and relieving purposes. There is a locking collar graduated in thousandths of an inch that is set to the required depth of cut. Feeds from 0.001 to 0.020 inch per stroke are obtainable by means of a ratchet feed mechanism that is also attached to the top plate. When the cutter reaches the predetermined depth, a friction member slips and stops the operation. This facilitates the duplicating of depths of cut without resetting.

The guide contains all the gearing necessary for transmitting power to a spiral pinion and rack that reciprocate the cross-head and the cutter-bars. This guide is journaled in a trunnion member that moves in a line parallel with the upper surface of the top plate. Means are provided for locking the guide to the trunnion member. This enables the guide, cross-head, and bar to be adjusted to any angular position relative to the top plate for cutting tapers up to 1 inch per foot. The cutter travels according to this angular setting.

The shifting and stroke-adjusting mechanisms are attached to the column and driven by means of a universal shaft from the lower end of the guide. The driving unit includes a gear-box, in which two clutches run in opposite directions in a bath of oil. Reciprocation of the cutter is obtained by engaging one or the other of these clutches. This motion is transmitted to the guide through a universal-joint splined shaft. Power can be supplied to the gear-box by motors of various types. This keyway-cutter and slotting machine can be built in various sizes, with cutting strokes of from 30 to 60 inches.

Pratt & Whitney Hydraulic Vertical Surface Grinder

Table speeds from 0 to 100 feet a minute are available on a 14-inch vertical surface grinder equipped with a hydraulic table drive which is being introduced on the market by the Pratt & Whitney Co., Hartford, Conn. In addition to the higher range of table speeds, this new model is characterized by increased weight and power. The illustrations show both the inside and outside details.

The drive to the spindle is the same direct-geared arrangement that has been employed for many years in machines of this type built by the same concern. The motor is located on top of the column and power is transmitted to the grinding wheel through a pair of hardened nickel-steel spiral-bevel gears. These gears run in oil at all times. The level of the oil in the reservoir is maintained at a mark on a round gage provided on the front of the gear housing. Gears that give a spindle speed of 1265 revolutions per minute are regularly furnished, but special gear ratios can be supplied.

Preloaded ball bearings are provided for the spindle and drive mechanism. They are fully protected from dirt and moisture and are lubricated by a hand pressure pump. The spindle and wheel flange are made in one piece, the upper end being

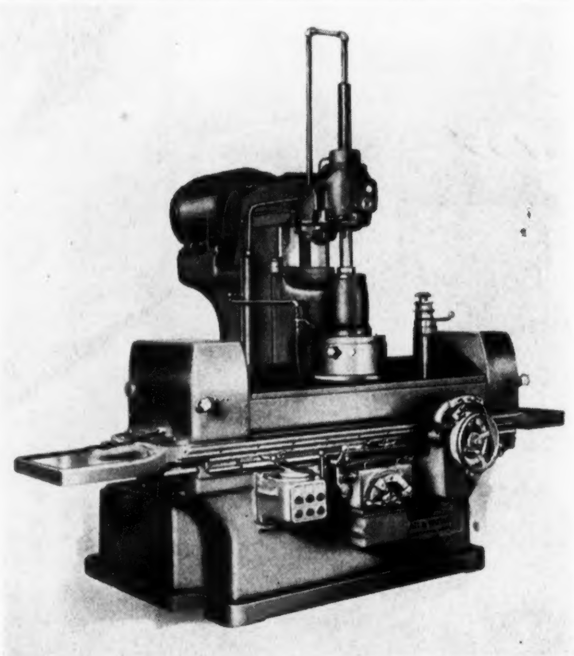


Fig. 1. Pratt & Whitney Vertical Surface Grinder Equipped with Hydraulic Table Drive

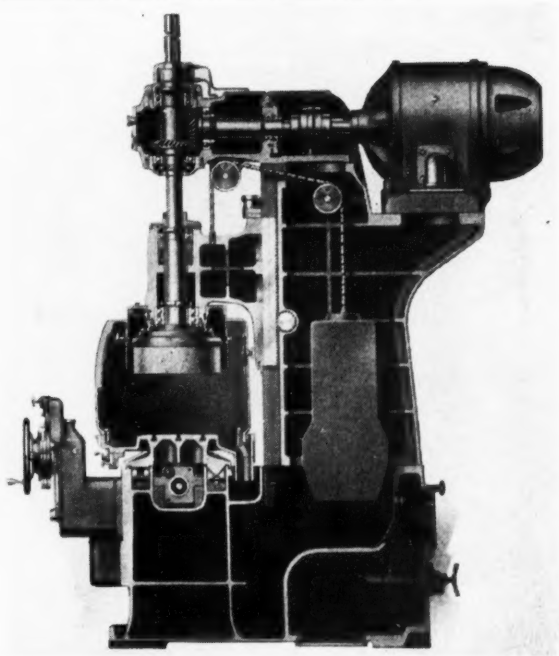


Fig. 2. Sectional View of the Surface Grinder, Showing Details of Inside Mechanisms

splined where it slides through the spiral-bevel gear. The lower spindle bearing absorbs the thrust of the grinding cut. End play of the spindle and wheel sag are prevented by compression springs which support the upper bearing.

The wheel is 14 inches in diameter, 5 inches high, and 1 1/2 inches thick. It is held in a cast-iron mounting that is bolted to the spindle flange. Truing is accomplished by means of a built-in device on the end of the table, which is graduated to save needless wheel waste. Power feeds of the wheel ranging from 0.00025 to 0.005 inch are obtainable at each end of the table stroke. In addition, either a slow or a fast hand feed is obtained by pulling the handwheel in or out.

The hydraulic equipment is driven by a five-horsepower motor mounted on the rear of the bed. Oil for the hydraulic system is carried in a tank in the column base and is drawn from the tank through a large Cuno filter. The control valve and lever for varying the table speed are located on the front of the bed. Two adjustable stops provide for quickly setting particular speeds, if desired. Automatic reversing of the table is effected at any point by means of dogs which are readily adjusted along a longitudinal rack on the front of the bed. The table can be reversed easily by hand if desired.

The sheet-metal guards with which the table is fully enclosed can be lowered or raised to confine the spray of coolant. Coolant is supplied to both the inside and outside of the grinding wheel from a tank in the bed. A 1/2-horsepower motor drives the built-in coolant pump.

All controls are grouped on the front of the machine. There is a push-button control for the three motors, and on top of the box that contains the push-buttons there is a lever for magnetizing and demagnetizing the magnetic chuck. Red lights in the push-button box show which way the electric current is being applied.

The machine weighs approximately 12,000 pounds, including the three motors. The table has a working surface of 12 by 36 inches and a maximum travel of 45 inches. The magnetic chuck has a working surface of 11 by 34 inches. The floor space occupied is about 14 by 7 feet.

Niagara Inclinable Press of Improved Design

A No. A-5 inclinable power press embodying a number of important improvements has recently been brought out by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. One of the new features is a one-piece steel-casting frame that has been designed to provide maximum rigidity vertically, horizontally, and torsionally, as well as around the gib mountings, the upper bearings, and the back-shaft mounting.

The 5-inch diameter crankshaft has a 6 1/4-inch crankpin. The crankshaft runs in bronze bearings which are split at an angle of 45 degrees, so as to transmit the entire thrust directly to the frame and avoid having the center of the bearing load occur on a joint between the bearing cap and the frame.

A six-point engagement pin clutch provides prompt engagement and a large number of strokes per minute. This clutch contributes to safe operation, because the number of engagement points eliminates lag and thus enables the operator to synchronize his feet and hands. A safety stop prevents repeating through over-travel of the shaft. There is a device for locking the clutch pin out of engagement when setting dies. The facing of the six-point engagement wheel is a solid, hardened and ground forging that can be easily removed and renewed.

Niagara Inclinable Press which Embodies a Number of Improved Features

The brake is equipped with a spring that automatically compensates for expansion due to heat of operation and also for wear. The brake block and band are marked to indicate the correct adjustment, thus eliminating guesswork. The slide is designed to provide unusually generous support for the die, the solid casting of the slide being brought forward to furnish a substantial backing for the die.

A new breech-block type of die clamp is used. This clamp is cylindrical in shape and is ground to a close tolerance. It fits into a

bored hole, the center of which is high enough above the bottom of the slide to prevent it from sagging. The clamp has no vertical play and supports the die solidly under pressure.

The back-gear shaft runs in Timken bearings. This shaft, with its bearings, is mounted in a heavy tubular casing that makes a self-contained assembly. Two holes are bored in the frame at the same setting as the main bearings to carry this assembly. This arrangement insures alignment and eliminates loose caps, brackets, bolts, etc. The press can be inclined easily by one man, due to the fact that the inclining device is equipped with anti-friction thrust bearings. It is located sufficiently above the floor so that a man can operate the inclining device while standing up. Patents have been granted and are pending on this machine.

Van Norman Small-Sized Miller

The Van Norman Machine Tool Co., Springfield, Mass., is placing on the market a No. 6 miller that differs from the other milling machines built by the concern in that it is of smaller size and is provided with hand feeds only. This machine is designed primarily to handle the wide range of operations that occur in tool-rooms, experimental shops, and pattern shops with minimum set-up time.

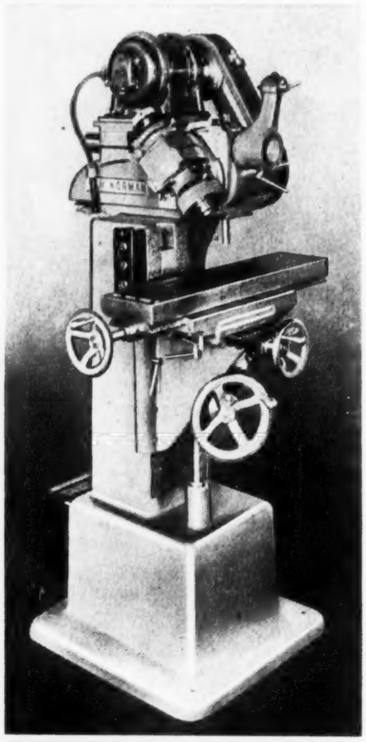
As on all Van Norman millers, the cutter-head can be swiveled for milling vertically, horizontally, or at any angle. Combined adjustments of the cutter-head and the ram make it possible to mill to any angle throughout the full travel of the table with a standard milling cutter. On practically any piece, all operations can be performed without disturbing the original set-up.

Sliding gears and three-step pulleys controlled by quick-change levers provide nine speeds from 80 to 1450 revolutions per minute. Anti-friction bearings are used throughout.

Landis Tap-Chaser Rake-Grinding Attachment

A fixture or attachment designed for regrinding or sharpening the chasers used in Landis Style LT and LM receding-chaser collapsible taps is being placed on the market by the Landis Machine Co., Inc., Tap Division, Waynesboro, Pa. The chasers used in the Victor collapsible and receding-chaser taps can also be ground with this attachment. The manufacturer points out that the correct sharpening of tap chasers is important, because improperly ground chasers frequently mean poor threads and short life. Different rake angles are required for different materials to be tapped.

The attachment is composed of three main parts. There is a base suitable for fastening to the table of most makes of tool- and cutter-grinding machines. Attached to the base is a swivel bracket that is adjustable in the horizontal plane relative to the base. The bottom part of this swivel bracket is graduated to facilitate setting the chasers at the required angles.



Hand-fed Small-sized Miller Added to the Van Norman Line

Attachment for Sharpening the Chasers of Landis Collapsible Taps

The third part of the attachment is a vise base which is clamped to the swivel bracket. It holds the chaser to be ground. The vise base can be rotated in the vertical plane and securely clamped at any angle as determined by graduations on top of the swivel bracket. This permits setting the chaser at the proper elevation for accurately grinding a gun tap in the throat section of the rake.

The vise base has a milled flat that accommodates all sizes of tap chasers. The chaser is held in place by means of an adjustable spring clamp and is effectively locked by means of a hand-screw.

Interchangeable Chaser-Blade and Holder for Threading Dies

The National Acme Co., 170 E. 131st St., Cleveland, Ohio, has developed an interchangeable chaser-blade and holder for use on threading dies manufactured by the concern. This chaser-blade and holder are designed to meet the needs of shops where changes from one job to another are frequent. Each chaser-blade is slipped into a slot in the block with both ends protruding. On one end are the threads of the chaser, while on the other end is ground a heel or cam that seats snugly

Interchangeable Chaser-blades and Holders on Namco Die-head

in the cup. This heel insures an accurate opening action. By making the cutting edge and the heel into one blade, correct location of the cutting edge is obtained. Also, each chaser will cut the same depth of chip, which is essential for obtaining accuracy of lead.

The blade is made wider than the depth of the slot, so as to provide for a large number of grinds. Two hollow-head screws are used to fasten the blade to the block. Only two sets of blocks are required for the entire range of cutting sizes.

Chasers and blocks of these new designs are also interchangeable with circular chasers and holding blocks of corresponding die size, in either rotating or non-rotating die-heads. Blades and holders from 1/4 to 1 inch are regularly stocked.

Ames Upright Gage of Improved Construction

Ames Improved Upright Gage

Improvements have recently been made in the construction of the No. 13 upright gage manufactured by the B. C. Ames Co., Waltham, Mass., with the view of supporting the dial gage more rigidly and of providing a means of quickly and positively clamping the bracket to the column. The cast-iron base has a ground top surface of 8 by 8 inches. It supports a steel column 1 1/4 inches in diameter. The bracket that holds the gage extends about 4 inches over the base, bringing the gage directly above the center of the base. This bracket is securely fastened to the column at convenient heights by merely turning a binding screw of large diameter.

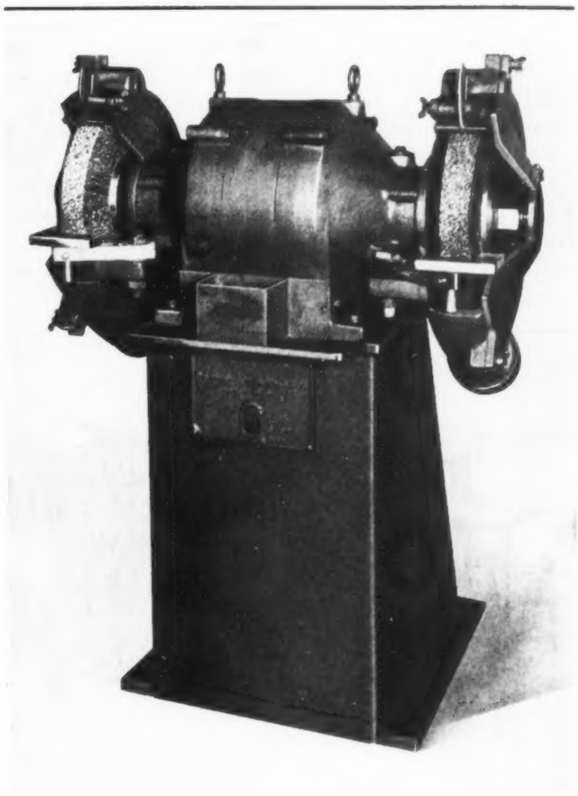
The gage regularly supplied is graduated in thousandths of an inch. A small hand indicates the number of revolutions made by the large hand. The spindle is raised 3/10 inch by depressing a lever at the left of the dial. Other Ames gages can be provided.

The cast-iron parts of this upright gage are annealed, while the steel parts are chromium-plated to prevent rusting.

Floor-Stand Grinding Machine for Heavy-Duty Service

A floor type grinding machine designed for the most severe type of duty has been added to the line of motor-driven machines built by the Production Equipment Co., 5219 Windsor Ave., Cleveland, Ohio. The motor on this machine is fully enclosed and is constructed to carry heavy overloads without excessive heating. It is equipped with ball bearings that are oil-lubricated. In machines of normal width, two bearings are provided for the wheel-spindle, but in wide designs of the grinder, four bearings are supplied. The alloy steel spindle and the ball bearings are of large size.

Safety type welded-steel guards with an exhaust connection and a hinged end-cover are standard equipment of these grinders. Starters of the automatic type are located in the base, the push-buttons being positioned conveniently on the front of the pedestal. This grinding machine is built in ratings of from 3 to 10 horsepower, with wheels ranging from 14 to 24 inches in diameter, inclusive.



Grinder Built by the Production Equipment Co. for Heavy-duty Service

Fig. 1. Solenoid - operated Switch with Explosion-proof Enclosure

Fig. 2. Allen-Bradley Oil-Immersed Solenoid-operated Switch

Allen-Bradley Solenoid-Operated Switches

Two additional enclosures or housings for solenoid-operated switches, recently designed by the Allen-Bradley Co., 1331 S. First St., Milwaukee, Wis., are shown in the accompanying illustrations. These enclosures supplement the Types B, D, and E enclosures described in February MACHINERY, page 381.

The Type G explosion-proof enclosure shown in Fig. 1 was heretofore supplied only for Size 1, Bulletin 709 solenoid-operated, across-the-line switches. It is now also available for Sizes 2 and 3 switches, which are intended for polyphase motors up to 15 horsepower, 110 volts; 30 horsepower, 220 volts; and 50 horsepower, 440-550 volts. They are also intended for self-starting, single-phase motors.

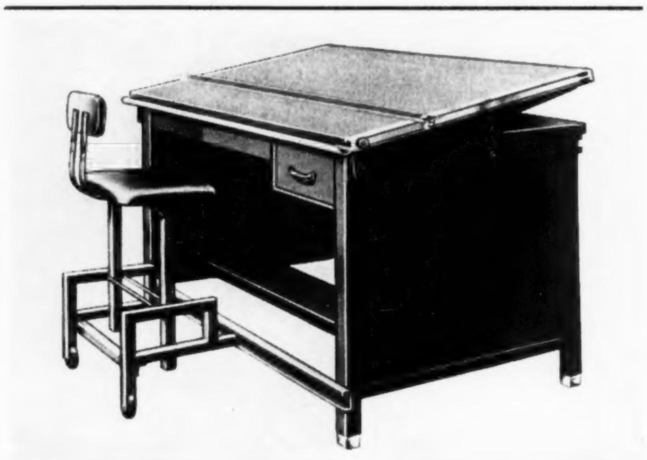
The Type G enclosure meets the requirements for Class 1, Group D hazardous gas locations, such as dry-cleaning establishments, gasoline filling stations, or any other place where inflammable gases or vapors may be present. The enclosure is made of cast iron, and is black enameled outside. A white enamel interior makes all terminals, switch parts, and overload relays stand out plainly, for easy installation and inspection. Heated gases created by any accidental internal explosion will be cooled before reaching the atmosphere by passing between the wide-flange machined surfaces provided on the cover and base of the cabinet.

Protection against corrosive gases is afforded by oil immersion in Type H (explosion-proof) and Type J (general application) enclosures of the design illustrated in Fig. 2. These enclosures are intended for Sizes 2 and 3 switches of Bulletin 709 solenoid-operated, across-the-line starters. Starters equipped with these enclosures will take care of the same motors as the Type G enclosure. In the Type H enclosure, the hood and oil tank are made of cast iron, whereas the Type J enclosure has a cast-iron hood and a sheet-metal oil tank. On both types, the hood and tank are cadmium-plated.

Drafting-Room Tables, Chairs, and Lights

For the convenience of draftsmen, the Hamilton Mfg. Co., Two Rivers, Wis., has designed a coaster chair that is attached to the front of a drafting table as illustrated. This chair can be moved laterally along the table with ease by the man sitting on it, and it is so designed that the seat swings forward and backward, there being a pivot in the lower part of the frame.

The seat can be adjusted for height and for distance from the table to suit individual needs. Ball-bearing fiber wheels on the horizontal legs of the chair run in the channel-iron guides, fastened to the front table legs. The outer legs of the chair are provided with ball-bearing casters that roll on the floor.



Drafting Table Equipped with Hamilton Coaster Chair

Another new product of this concern is a set of three adjustable lights arranged to permit satisfactory illumination of drawing boards. These lights are attached to a ball-bearing unit that runs in a channel iron mounted on the back edge of the drawing-board. Thus, the battery of lights can be conveniently positioned where needed.

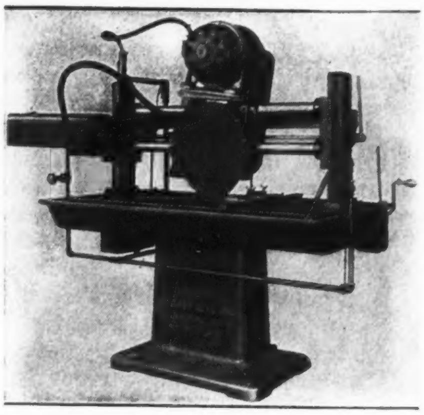
The same concern is also introducing

on the market a line of drafting tables of combined steel and wood construction. These tables are made in three sizes with a variety of drawer combinations to suit various drafting-room requirements. Instead of the standard 30-inch height, the tables are built to a height of 37 inches, the concern having decided that the latter dimension is the proper working height for a four-post table. The drawing-board is adjustable to various angles.

Campbell Horizontal Wet Abrasive Cutting Machine

Long cuts can be taken through flat or slab stock by a Model 302 horizontal wet abrasive cutting machine recently added to the line of the Andrew C. Campbell Division of the American Chain Co., Inc., Bridgeport, Conn. Bar stock can also be handled. The wide variety of materials that can be cut by this machine includes hardened steel, alloys of all descriptions, cast iron, copper, glass, porcelain, stone, and tile.

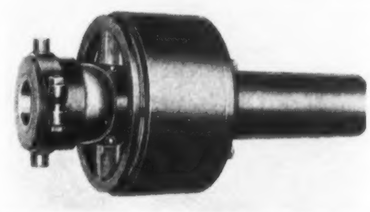
The machine is equipped with a hydraulic mechanism for feeding the wheel across the work. The hydraulic feed can be regulated infinitely between the maximum and minimum rates. This feature is of especial importance in cutting glass or other fragile materials, and it also facilitates obtaining maximum wheel life in cutting steels. Coolant is supplied continuously in a uniform amount to the thin revolving abrasive disk which does the cutting. With this type of cutting, dust- and grit-laden air is avoided.



Wet Abrasive Cutting Machine for Taking Long Cuts

Kinney Single-Point Adjusting Disk Clutch

A small fully enclosed, single-point adjusting disk clutch placed on the market by the Kinney Mfg. Co., 3541 Washington St., Boston, Mass., is shown in the illustration. This clutch is designed for use either as an integral part of a machine or for the general transmission of power. It is made in three general sizes, with capacities ranging from 1 to 6 horsepower per 100 revolutions per minute. Single or double disks are provided. The clutch is made in a sleeve type with several styles of sleeve bearings, and also as a cut-off coupling.



Kinney Fully Enclosed Disk Clutch

One of the important advantages of this clutch is that it may be run at high speed with the transmitting capacity in direct ratio to the speed. The friction disks have asbestos faces that permit an unusual amount of slippage in starting a load, so that easy pick-up of the load is accomplished without jar or vibration. An unusually short movement of the shifter cone engages or releases the disks. Working parts of the shifting mechanism are heat-treated.

Fig. 1. Electric Motor with an Integral Magnetic Brake

Magnetic-Brake and Torque Motors

The Electric Specialty Co., Stamford, Conn., has developed a line of motors with magnetic brakes for use on hoists, winches, cranes, and other equipment that must hold the load whenever the power is shut off from the motor. One of these motors is illustrated in Fig. 1. When electric power is not applied to the terminals of these motors, calibrated springs press the stationary and rotating disks together. Brake linings are mounted on the rotating disks, the latter being fastened to the motor shaft. As soon as power is applied to the motor, electromagnets counteract the action of the springs and release the braking pressure on the disks, thus allowing the motor shaft to rotate freely.

The entire brake is built integral with the motor to form a compact unit. The electro magnet windings are connected to the motor supply leads inside of the motor, thus simplifying the installation and insuring correct wiring. The line includes both alternating- and direct-current motors of single, multiple, and variable speeds.

The same concern makes a specialty of building torque motors for many applications. The practice is to design these motors individually for each job, because of the fact that the duty cycle is different for almost every job. Some applications require reversing under load or

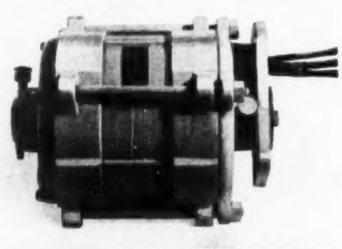


Fig. 2. Typical Torque Motor Made by the Electric Specialty Co.

plugging on the line. Some motors must remain stalled on the line for long periods, while others must operate at high speed during part of the cycle, and at lower speeds during other parts of the cycle. Again, some motors must operate continuously and others occasionally. Another factor in the design of torque motors is that the construction must be adapted to the machine or equipment on which they are to be installed.

Torque motors have been made for operating valves, elevator doors, elevator control equipment, lathe power chucks, etc. A motor designed for controlling a valve is shown in Fig. 2.

Signal One-Quarter Inch Portable Electric Drill

A 1/4-inch standard-duty portable electric drill of the design illustrated has been placed on the market by the Signal Electric Mfg. Co., Menominee, Mich. This drill is equipped with a universal motor for operation on direct or alternating current of 110 to 120 volts. The drill has a no-load speed of 1700 revolutions per minute.

Latest Addition to the Line of Signal Portable Electric Drills

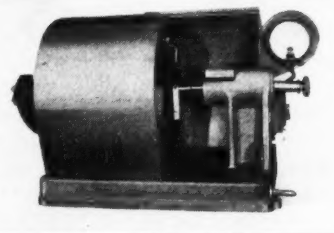
Heat-treated alloy steel gears are provided. The brushes are accessible from the outside. A positive make-and-break toggle switch is supplied as standard equipment. The housing is an aluminum alloy. The drill has an over-all length of 12 inches and a net weight of 7 1/4 pounds.

Covel Universal Angle Vises

Universal angle vises that enable grinding, milling, drilling, etc., to be performed at any combination of angles are being placed on the market in two sizes by the Covel Mfg. Co., Benton Harbor, Mich. These vises can be used for grinding tool bits, chasers, formed cutters, etc., and they are especially adaptable to sharpening tungsten-carbide cutters to required shapes and clearance. The smaller size vise is equipped with jaws 2 3/4 inches wide that open to 1 1/4 inches, while the larger size has jaws 4 inches in width that open to 2 1/2 inches.

Covel Universal Angle Vise for Various Machine Tools

The work is held in the vise by a fulcrum clamp. The angular adjustments are locked by means of hardened nuts. The construction of the vises is such that there is no danger of the work or adjusting nuts slipping while normal cuts are being taken.



Torsion Impact Testing Machine of High Stored Energy Content

Torsion Impact Testing Machine of High Capacity

The Baldwin-Southwark Corporation, Philadelphia, Pa., recently built for the Republic Steel Corporation a torsion impact testing machine with sufficient stored energy for testing any known steel in specimens up to 1 inch in diameter. With many steels, specimens up to 1 3/8 inches in diameter can be tested. This instrument, which is shown in the accompanying illustration, is believed to provide a stored energy content 100 times that of any such previous machine—50,000 foot-pounds at 1000 revolutions per minute.

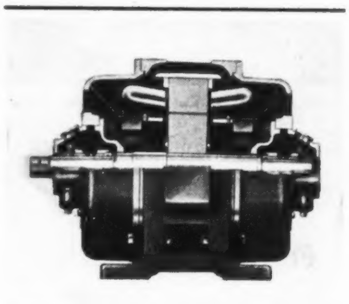
Harnischfeger Convertible Motors

Squirrel-cage and slip-ring induction motors that can be readily converted from the open type to fan-cooled, splash-proof, or totally enclosed constructions are being placed on the market by the Harnischfeger Corporation, W. National Ave., Milwaukee, Wis. The line includes all standard frequencies, for service ranging from 110 to 220 volts. The open type of motor is shown in the illustration in partial cross-section. The conversion of these motors is accomplished by designing the frame, the end heads, and the bearings to permit interchangeability. This development enables machinery manufacturers to readily adapt standard alternating-current motors to various service requirements.

The stator laminations are stacked between heavy steel end

rings, and the entire assembly is then welded to the frame. This construction provides maximum rigidity and makes it impossible for the stator core to shake loose. The rotor windings are assembled from round or rectangular hard-drawn copper bars, which are placed in the rotor slots without insulation or wedges. The ends of the bars are brazed to the end rings with an electric arc torch.

Motors ranging from 1/2 horsepower running at 600 revolutions per minute up to 125 horsepower running at 3600 rev-



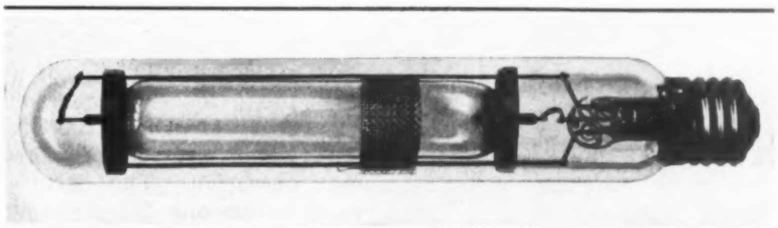
Open Type Motor which can be Converted into Three Other Types

olutions per minute are included in the line, as well as single- or multi-speed models.

General Electric High-Intensity Mercury Vapor Lamp

A high-intensity mercury vapor lamp that is particularly suitable for the lighting of high bays in industrial plants has recently been developed by the General Electric Vapor Lamp Co., 613 Adams St., Hoboken, N. J. This lamp constitutes a new approach to an industrial white light that is restful to the eye. It promotes continued use of the eyes without fatigue. The lamp produces 14,000 lumens at a consumption of 400 watts, or approximately 35 lumens per watt.

A Mogul screw base provides for mounting the lamp vertically. It has an over-all length of 13 inches and is designed for



G. E. Mercury Vapor Lamp of High Intensity which is Especially Suitable for Lighting High Shop Bays

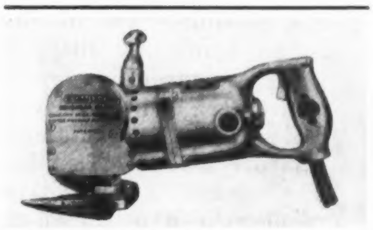
operation on 110- and 220-volt, 60-cycle circuits. The average life of this new industrial lamp is 1500 hours.

Although the high-intensity light produced by this lamp appears white to the observer, it is really a combination of blue and yellow-green light. Owing to the fact that red rays are practically absent in the light, true color values are not always rendered when red materials are involved, but this is of little importance in the general industrial field.

Portable Stanley-Unishear

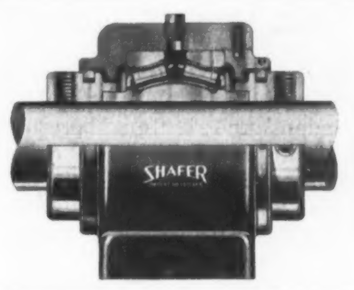
Hot-rolled steel up to No. 14 gage and other materials in proportion can be cut at speeds up to 15 feet a minute with a portable Unishear recently brought out by the Stanley Electric Tool Division, New Britain, Conn. This device will cut to straight lines, curves, or angles. Circles can be cut to a minimum radius of 2 1/2 inches. Inside cuts can be made by punching a 3-inch hole in the sheet and then slipping the yoke of the device through the hole.

This portable equipment weighs approximately 19 1/2



Portable Stanley-Unishear for Stock up to No. 14 Gage

pounds. It is driven by a universal motor. The cutter blades can be easily removed for sharpening, when necessary.



Shafer Pillow-block with Piston-ring Seal and Square Collar Design

New Features of Shafer Roller-Bearing Units

The standard-duty roller-bearing pillow-blocks and other self-aligning units manufactured by the Shafer Bearing Corporation, 6519 W. Grand Ave., Chicago, Ill., are now provided with piston-ring seals and collars of a square design, as illustrated. The bearing inner race of a unit has four flats on the outside diameter. These flats are engaged on each side by corresponding flats on the inside diameter of the two locking collars. Each collar carries a piston-ring that provides an effective seal for excluding dirt, dust, and water, except under the most extreme conditions. Two set-screws provide for clamping each collar to the shaft.

The new piston-ring seal and square collar design insure long, satisfactory service without attention.

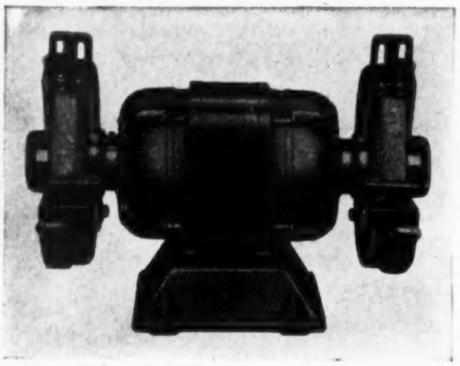


Fig. 1. Skilsaw Bench Grinder

Skilsaw Bench, Pedestal, and Hand Grinders

A new line of bench and pedestal grinders and combination grinders and buffers has been added to the electrically driven products of Skilsaw, Inc., 3310 Elston Ave., Chicago, Ill. One of the bench grinders of this line is illustrated in Fig. 1.

The totally enclosed motors provided on these machines are dynamically balanced to eliminate vibration, and they are equipped with ball bearings that are sealed and grease-lubricated to give long life. On the bench grinders, the motors range from a 1/6-horsepower, split-phase or condenser type on the 6-inch size, to a 1 1/2-horsepower, 220-volt, three-phase type on the 10-inch size.

The same concern has also recently developed the electric hand grinder shown in Fig. 2, which runs at a speed of 18,000 revolutions per minute. This tool is particularly suitable for a large variety of operations in general production work, in making dies and molds, etc. The body of the grinder is made entirely of molded Bakelite, which provides for cool operation. The grinder weighs only 2 1/4 pounds.

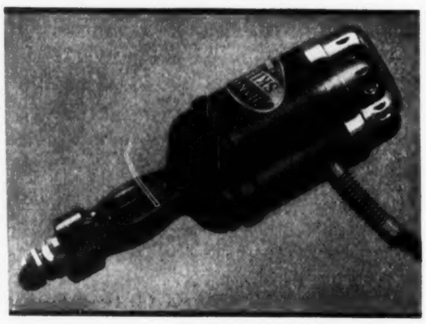
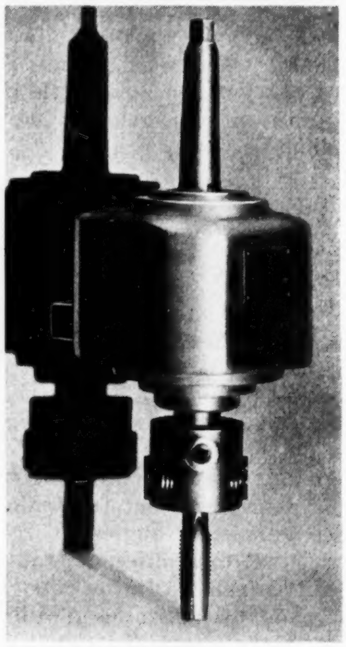


Fig. 2. Skilsaw Electric Hand Grinder

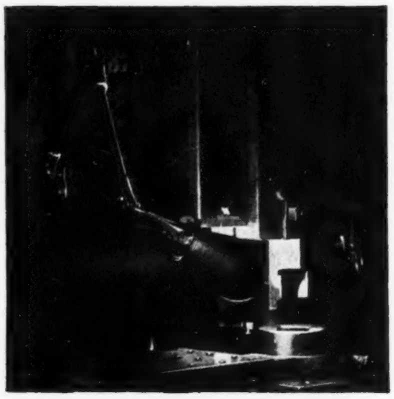
Biax High-Speed Tapping Attachment

Taps from 1/4 to 3/4 inch can be used in a No. 2 tapping attachment recently added to the Biax high-speed line of the Charles L. Jarvis Co., Gildersleeve, Conn. As with the smaller sizes made by this concern, the new attachment is completely equipped with ball bearings. The housing is an aluminum alloy, all gears are made of chrome-nickel steel, and the forward and reverse friction members are made of Textolite. The gears and friction members run in an oil-absorbing grease. It is claimed that the design practically eliminates tap breakage.



Biax Tapping Attachment

When the three sizes of tapping attachments made by the concern are supplied to a customer, they are shipped in a metal box.



Lamp which can be Positioned to Suit Machine Operations

Fostoria Industrial Machine Lamp

The Fostoria Pressed Steel Corporation, Fostoria, Ohio, has brought out a lamp designed specifically for application to machines. The illustration shows a typical use. The bracket of this lamp is provided with three ball-and-socket joints that enable the machine operator to place the lamp in any position for obtaining maximum illumination of the work and tools.

The light cord is contained in the bracket itself, which is made of steel tubing. The shade is aluminum and is of such a size that bulbs can be conveniently changed without removing it. The shade is shaped to provide maximum protection to the bulb.

* * *

Just what services does the Bureau of Foreign and Domestic Commerce render? This question has been asked by many business men; and, in order to answer it, the Bureau has prepared a brief statement entitled "Bureau of Foreign and Domestic Commerce," which may be had upon application to the Bureau, Washington, D. C.

NEWS OF THE INDUSTRY

California

A. H. SKAER has been placed in charge of the Cochise Rock Drill Mfg. Co., a subsidiary of the Independent Pneumatic Tool Co., Chicago, Ill. Mr. Skaer was formerly associated with the Denver Rock Drill Mfg. Co. and for many years was its president. He will make his headquarters in Los Angeles, where the Cochise plant is located.

Illinois and Missouri

LINK-BELT Co., 910 S. Michigan Ave., Chicago, Ill., announces the following changes in its central division conveyor sales organization: WILLIAM L. HARTLEY, heretofore manager of the Detroit office, is now manager of foundry equipment sales, with headquarters in Chicago. HAROLD L. HOEFMAN, previously manager of the Indianapolis branch, succeeds Mr. Hartley as manager of the Detroit office. RICHARD B. HOLMES, of the St. Louis office, succeeds Mr. Hoefman as manager of the Indianapolis branch. CARL A. BLOMQUIST, of Chicago, succeeds Mr. Holmes at St. Louis, where he will assist HOWARD L. PURDON, manager.

GEORGE E. OSBORN has been appointed vice-president and general manager at Chicago of the Lamson and Sessions Co., western subsidiary of the Lamson & Sessions Co., 1971 W. 85th St., Cleveland, Ohio, to fill the vacancy caused by the death of A. J. Boyle. Mr. Osborn was previously in charge of sales in the Iowa and Missouri River territory. GEORGE S. CASE, JR., has been appointed assistant general manager at Chicago. Mr. Case became affiliated with the parent company in 1930, and since then, has worked in various capacities in the operating departments of all the different plants, as well as in the sales department.

George E. Osborn, New General Manager at Chicago of the Lamson and Sessions Co.

L. A. SHEA has been appointed district manager for the state of Illinois and the upper half of the state of Indiana by the Hevi Duty Electric Co., Milwaukee, Wis. His office will be at 205 W. Wacker Drive, Chicago, Ill. He will have charge of the company's service and sales agency on electric heat-treating furnaces. Mr. Shea was formerly district manager for the state of Ohio.

OHIO FORGE & MACHINE CORPORATION, Cleveland, Ohio, successor to Gears & Forgings, Inc., manufacturer of gears, speed reducers, forgings, and special machinery, announces the appointment of the DENTON & ANDERSON CO., 1225 W. Washington Blvd., Chicago, Ill., as its representatives in the Chicago territory. Associated with GEORGE E. KING in this office are CLYDE G. BASSLER, C. A. GOULD, and JOHN R. POYSER.

COLUMBIA TOOL STEEL CO., Chicago Heights, Ill., announces the removal of its Chicago branch office and warehouse to larger and more centrally located quarters at 326-328 N. Western Ave. With 5500 square feet of space and increased equipment, more complete stocks of tool steel will be carried at the new location. THOMAS G. DOUGALL is in charge of the Chicago territory.

BRYANT MACHINERY & ENGINEERING CO., 400 W. Madison St., Chicago, Ill., has been appointed exclusive agent for the DeVlieg Milling Machine Co., in the general Chicago and St. Louis territories.

GEARS & TRANSMISSIONS CO. has been organized at 3600-08 S. Oakley Ave., Chicago, Ill., for the purpose of rendering service on gear and other transmission requirements.

RALPH H. CLORE has been appointed general sales manager of the Medart Co., Potomac and DeKalb Sts., St. Louis, Mo., manufacturer of power transmission machinery. Mr. Clore, formerly general sales manager of the United States Electrical Tool Co., succeeds F. P. KOHLBRY, who has assumed active charge of the Machinery & Welder Corporation, Chicago, Ill.

Athel F. Denham Heads New Automotive Technical Advisory Publicity Service

Michigan

ATHEL F. DENHAM, for the last eight years Detroit editor of the Chilton Co., publishers of *Automobile Trade Journal*, *Automotive Industries*, and *Commercial Car Journal*, has resigned and has inaugurated an automotive technical advisory service on advertising and publicity, with headquarters at 1235 Lafayette Bldg., Detroit, Mich. The service is designed for automotive concerns selling to the public and to industry, and also for non-automotive companies who wish to reach the automotive industry with their sales message.

DETROIT ELECTRIC FURNACE CO., 825 W. Elizabeth St., Detroit, Mich., has recently completed arrangements with the BIRMINGHAM ELECTRIC CO., of Birmingham, England, for the manufacture and sale in Great Britain, the British Empire, and certain other European countries, of the Detroit rocking electric furnaces, which will be manufactured and sold abroad under the name of "Birlec Detroit" rocking furnaces.

New England

WINDSOR AUTOMATIC CO., Windsor, Vt., has been formed to manufacture a new short-run, quick set-up, automatic turret lathe developed by a resident of Windsor. The financial set-up, we understand, is not yet completed, but as soon as satisfactory arrangements have been made, the company will be ready to start manufacturing.

DONALD S. SAMMIS has been appointed superintendent of the Bridgeport factory of the Underwood Elliott Fisher Co. For twenty years, following his graduation from the Sheffield Scientific

School of Yale University, Mr. Sammis has served industry in various capacities as engineer, superintendent, and general manager.

New Jersey and New York

GROPLER BROS. announce that the name of the firm has been changed to ERNEST T. GROPLER CO., and that the concern has moved from 105 Hudson St., New York City, to 1060 Broad St., Newark, N. J., where larger quarters have been secured. The company is industrial sales representative of the Federal-Mogul Corporation and the Gairing Tool Co., both of Detroit, Mich., and of the Gammons-Holman Co., Manchester, Conn., and the Madison Mfg. Co., Muskegon, Mich.

GISHOLT MACHINE CO., 1209 E. Washington Ave., Madison, Wis., announces the opening of a new eastern district sales office at 538 Industrial Building, 1060 Broad St., Newark, N. J. R. D. Heflin, for many years eastern representative of the company, is in charge of the new office.

NEWARK GEAR CUTTING MACHINE CO., INC., 69 Prospect St., Newark, N. J., at the last annual meeting of the company, elected the following officers: President, Frank E. Eberhardt; vice-president and treasurer, U. Seth Eberhardt; and secretary, Henry J. Eberhardt.

HOWARD KETCHAM, who has been director of the Duco Color Advisory Service of E. I. du Pont de Nemours & Co. and editor of the *Automobile Color Index*, has opened an office at 545 Fifth Ave., New York City, to specialize in the application of color in industry. Mr. Ketcham will continue his work for the du Pont company as a color consultant.

B. W. BULLOCK has been appointed assistant manager of the publicity department of the General Electric Co., Schenectady, N. Y., and also assistant manager of broadcasting.

Ohio

R. S. ARCHER, chief metallurgist of the Chicago District of the Republic Steel Corporation, Youngstown, Ohio, recently addressed the Toledo, Ohio, chapter of the American Society for Metals on the subject "Iron and Steel of Better Quality." Mr. Archer is vice-president of the American Society for Metals. N. L. DEUBLE, also of the metallurgical staff of the company, spoke before the Minneapolis chapter of the Society on February 12. His subject was "Metallurgical Inspection." HARRY W. MCQUAID, another member of the metallurgical staff, addressed the Buffalo chapter on February 14. Mr. McQuaid's address dealt with "Grain Size." C. C. SNYDER, also of the Republic Steel Corporation, addressed a dinner meeting of the Electro Chemical Society the latter part of January at the Hotel Bolton Square, Cleveland, on "Stainless Steel as Applied to the Chemical Industries."

AMBROSE SWASEY, chairman of the Warner & Swasey Co., Cleveland, Ohio, was the recipient of the 1933 Washington Award, which was founded eighteen years ago by John W. Alvord. The award was made at a dinner on February 20. The first Washington Award was made to Herbert C. Hoover, in 1919. The award is administered jointly by a commission appointed from the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the Western Society of Engineers. It was conferred upon Mr. Swasey in recognition of the services he has rendered and the inspiration his professional life has been to fellow engineers.

ARTHUR J. TUSCANY, Cleveland, Ohio, has resigned as executive secretary of the Gray Iron Founders' Society, Inc., Cleveland, Ohio, which position he has held for the last seven years, and has established headquarters at 1213 W. Third St., Cleveland, to provide active and advisory service to trade associations and code authorities.

CLIFFORD S. STILWELL was elected a vice-president of the Warner & Swasey Co., Cleveland, Ohio, precision instrument and turret lathe builders, at the last annual meeting of the company. Mr. Stilwell has been associated with the Warner & Swasey Co. for twenty three years, during the last four of which he has been sales manager.

Clifford S. Stilwell, Newly Elected Vice-president of the Warner & Swasey Co.

FOSTORIA PRESSED STEEL CORPORATION, Fostoria, Ohio, maker of the Fostoria Sorwal coolant filter, announces the appointment of Fred D. Rankins as sales manager of its newly created industrial division. Mr. Rankins has served the company for several years as district manager with headquarters in Boston, and is well known in industrial engineering circles.

CASE HARDENING SERVICE CO., 2281 Scranton Road, Cleveland, Ohio, has been appointed district representative for the state of Ohio of the Hevi Duty Electric Co., Milwaukee, Wis., manufacturer of electric heat-treating furnaces.

W. F. GRADOLPH has been elected vice-president in charge of sales of the DeVilbiss Co., Toledo, Ohio. Mr. Gradolph has been associated with the DeVilbiss Co. for the last twenty-four years.

Pennsylvania

HOMESTEAD VALVE MFG. CO., Coraopolis, Pa., announces the following exclusive representatives for the sale and distribution of Homestead valves: CAREY MACHINERY & SUPPLY CO., 119 E. Lombard St., Baltimore, Md.; L. E. LIVINGSTONE, 2012 Ward Parkway, Fort Worth, Tex.; CHARLES A. RANDORF, 83 Delham Ave., Buffalo, N. Y.; and ATKINS KROLL & CO., 260 California St., San Francisco, Calif., representative in the Philippine Islands.

E. F. HOUGHTON & CO., 240 W. Somerset St., Philadelphia, Pa., announces that the company has paid a service bonus to its employes for the year 1934, double the amount paid for 1933, the bonus consisting of $5 for each year of service up to ten years. A total of $50 was paid to those in the company's employ from ten to fifteen years, and $60 to those having been in the employ over fifteen years.

It is also announced that the following officers were elected at the last annual meeting of the company: Chairman of the board, Louis E. Murphy; president, Major A. E. Carpenter; vice-president, George W. Pressell; treasurer, Dr. R. H. Patch; and secretary, A. E. Carpenter, 3rd.

Wisconsin and Minnesota

WESLEY STEEL TREATING CO., 1321-1341 W. Pierce St., Milwaukee, Wis., at a recent meeting of the company, re-elected CHARLES WESLEY, SR., president and general manager. CHARLES I. WESLEY succeeds FRANK MARKS as vice-president and works manager. JOSEPH F. HUSHEK continues as treasurer, and

ARTHUR H. NUESSE assumes the position of secretary left vacant by Charles I. Wesley after twenty years of service.

WESLEY STEEL TREATING Co., Milwaukee, Wis., announces a new building program, the first step of which will be the construction of an addition to the firm's No. 2 plant at 1333 W. Pierce St., Milwaukee. The new unit will be 20 by 74 feet in size, one story high, and has been especially designed to house a continuous pusher furnace. The concern recently added new processing units to its No. 1 plant.

CLAUD S. GORDON Co., 314 Indiana Terminal Warehouse Bldg., Indianapolis, Ind., has been appointed district representative of the Hevi Duty Electric Co., Milwaukee, Wis. S. A. SILBERMANN, who has been acting as sub-agent for several years, will be in charge of the Indianapolis office.

E. H. CLARK, formerly St. Louis manager for the Rockbestos Products Corporation, has joined the Harnischfeger Corporation, Milwaukee, Wis., in a sales capacity. Mr. Clark will represent the corporation in the middle west and southwest territories, handling the sales of the new line of P & H convertible motors.

WESLEY STEEL TREATING Co., 1333 W. Pierce St., Milwaukee, Wis., has been granted an exclusive license by the Chapman Valve Mfg. Co., of Indian Orchard, Mass., to employ the Chapmanizing process on a commercial basis in the state of Wisconsin and in the coast cities of the state of Michigan until the year 1941.

W. G. NICHOL Co., Milwaukee, Wis., announces the removal of its offices from 1010 Mariner Tower to 709-711 W. Michigan St., where a larger display room has been secured on the street level.

ALLIS-CHALMERS MFG. Co., Milwaukee, Wis., announces the removal of its Pittsburgh district office to 2037 Koppers Bldg. GUY V. WOODY is manager of the Pittsburgh district.

S K F INDUSTRIES, INC., announce the opening of a new branch store at 407 S. 4th St., Minneapolis, Minn., with A. KISHKUNAS in charge. The new office carries a complete stock of S K F ball and roller bearings, pillow blocks, and hangers.

* * *

The feed-cam of an automatic screw machine in an automobile plant had to be replaced every six to twelve weeks because of wear. After hard-facing the edge of the cam with Stellite for its entire length to a depth of from 1/16 to 1/8 inch, the life of the cam was increased to one year. The cost of hard-facing was one-fourth of the cost of a new cam.

NEW BOOKS AND PUBLICATIONS

STANDARD GEAR BOOK. By Reginald Trautschold. 314 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, $3.

The purpose of this book, according to the author's foreword, is to supply the facts behind the important advances in commercial gear production practices during the last quarter century; to reiterate the basic principles upon which the operation of the modern gear-generating machines and the art of gear designing are founded; and to show how transmission efficiencies of 99 per cent plus have been attained. The book aims to be of assistance to the machine builder as well as to the gear designer. It contains working formulas and tables of use in gear design.

The text is divided into sixteen sections headed as follows: Tooth Forms; Speeds and Powers; Gear Proportions and Design; Spur Gear Calculations; Straight-tooth Bevel Gears; Helical and Herringbone Spur Gears; Spiral Gearing; Worm-Gearing; Spiral-Bevel, Skew-Bevel, and Hypoid Gears; Internal Gearing; Epicyclic Gear Trains; Gear Units; Methods of Gear Production; Materials and Heat-Treatment; Measurement of Gear Teeth; and Rolled Gearing.

PROCEEDINGS OF THE THIRTY-SEVENTH ANNUAL MEETING OF THE SOCIETY FOR TESTING MATERIALS. Issued in two volumes covering 2260 pages, 6 by 9 inches. Published by the Society, 260 S. Broad St., Philadelphia, Pa. Price, $5.50 per volume in paper binding; $6 in cloth binding; and $7 in half-leather binding.

The 1934 proceedings of the American Society for Testing Materials have been published in two extensive volumes. Part I contains the reports of forty-four standing committees, research and sectional committees. The material covers the standardization and research work that the committees have under way in their respective fields. Part II contains the technical papers read before the meeting. The materials covered include ferrous metals; non-ferrous metals; cementitious materials; and miscellaneous materials, such as paints, oils, etc.

MARKETING INDUSTRIAL EQUIPMENT. By Bernard Lester. 307 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, $3.50.

This book comprises a comprehensive study of the problems involved in distributing machinery and equipment from the manufacturer to the ultimate user. It is intended to assist those who are actually engaged in various phases of the distribution of machinery and engineering supplies, as well as students in technical and business schools. An idea of the scope of the work will be obtained from the following list of chapter headings: The Development of Industry; the Character and Extent of the Industrial Market; Production Machinery and Equipment Required by Industry; Analysis of Product, Market, Competitors, and Distribution; Distribution of Machinery and Equipment; Sales Expense; the Sales Organization; the Operation of the Headquarters Sales Organization; the Operation of the Field Sales Organization in Selling; Customer Analysis, Specifications, and Proposals; Sales Promotion; and Industry Cooperative Effort, Future Markets, and Marketing Tendencies.

MECHANICAL WORLD YEAR BOOK (1935). 360 pages, 4 by 6 1/4 inches. Published by Emmott & Co., Ltd., 31 King St. W., Manchester, England. Price, 1/6.

This is the forty-eighth edition of this little handbook for mechanical engineers. Two entirely new sections are included in the present edition; one covers compressors, and the other deals with the selection and application of pumps. Another new feature of the year book is the arrangement of certain sections in alternate editions. In this way, any two consecutive issues cover a much wider field than is possible with one. In all editions, however, the tabular matter and, in some cases, condensed data from other sections are included. As in previous editions, the book contains a great quantity of condensed mechanical data of value to engineers.

BOOK OF A.S.T.M. TENTATIVE STANDARDS (1934). 1257 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa. Price to non-members, $7 paper-bound; $8 cloth-bound.

This book contains 236 tentative specifications, methods of testing, definitions of terms, and recommended practices covering ferrous and non-ferrous metals, non-metallic minerals and miscellaneous material. Of these 236 tentative standards, 25 relate to ferrous metals and 25 to non-ferrous metals; 48 apply to cementitious, ceramic, concrete, and masonry materials; 127 cover miscellaneous materials such as paints, petroleum, insulation, textiles etc., while 11 are general testing methods applied to these materials.

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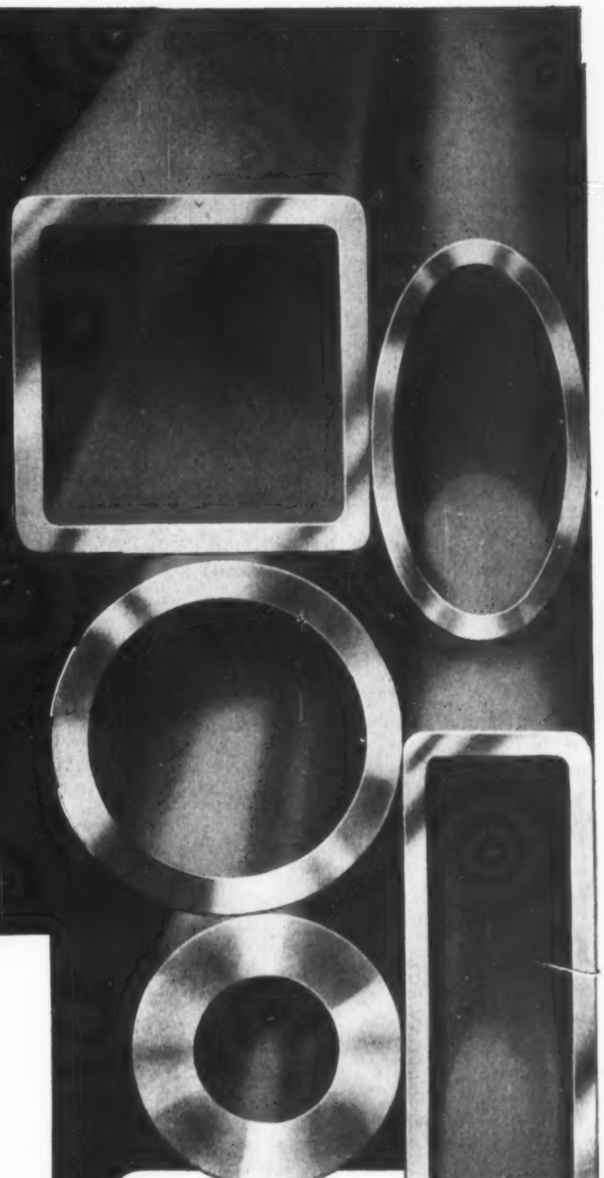

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SEAMLESS MECHANICAL TUBING

THE THIRTY-HOUR WEEK. By Harold G. Moulton and Maurice Leven. 20 pages, 6 by 9 inches. Published by the Brookings Institution, Washington, D. C., and distributed by the Automobile Manufacturers' Association.

This little pamphlet analyzes in a very able way the economic effects of the proposed thirty-hour week and arrives at the conclusion that the measure would not promote national welfare. It points out how this shortening of work hours would reduce the standard of living and would prove detrimental to the interests of labor, as well as to other classes.

WESTINGHOUSE ILLUMINATION HANDBOOK. 64 pages, 4 by 6 1/2 inches. Distributed by the Westinghouse Lamp Co., Bloomfield, N. J. Price, 10 cents.

In this little handbook, complete information is given on every phase of lighting design for the home, office, store, and factory. In the interior lighting section, there is a complete table giving recommended foot-candles for the lighting of different classes of industrial work.

PROTECTIVE VALUE OF NICKEL AND CHROMIUM PLATING ON STEEL. By William Blum, Paul W. C. Strausser, and Abner Brenner. 25 pages, 6 by 9 inches. Published by the U. S. Department of Commerce, Washington, D. C., as Research Paper RP712 of the National Bureau of Standards. Price, 5 cents.

INFLUENCE OF CHEMICALLY AND MECHANICALLY FORMED NOTCHES ON FATIGUE OF METALS. By Dunlap J. McAdam, Jr., and Robert W. Clyne. 46 pages, 6 by 9 inches. Published by the U. S. Department of Commerce, Washington, D. C., as Research Paper RP725 of the National Bureau of Standards. Price, 5 cents.

UNBALANCE IN ALTERNATING-CURRENT ROTATING MACHINES. By E. M. Sabbagh. 96 pages, 6 by 8 3/4 inches. Published by Purdue University, Lafayette, Ind., as Research Bulletin No. 45 of the Engineering Experiment Station. Price, 50 cents.

INDEX TO A S T M STANDARDS AND TENTATIVE STANDARDS. 142 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa.

COMING EVENTS

MARCH 3-10—LEIPZIG TRADE FAIR, Leipzig, Germany. For further information, address Leipzig Trade Fair, Inc., 10 E. 40th St., New York City.

MARCH 5-8—FIFTH PACKAGING EXPOSITION to be held at the Palmer House, Chicago, Ill., under the auspices of the American Management Association. The exposition will cover packaging, packing, and shipping. For further information address Roberts Everett Associates, Inc., 232 Madison Ave., New York City, managers of the exposition.

MARCH 6—Regional meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at Philadelphia, Pa. Secretary's address, 260 S. Broad St., Philadelphia, Pa.

MARCH 18—Joint meeting of the Chicago Section of the AMERICAN FOUNDRYMEN'S ASSOCIATION, the WESTERN SOCIETY OF ENGINEERS, and the Chicago Section of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in the Engineering Building, 205 W. Wacker Drive, Chicago, Ill. Subject: "Engineering Uses of Modern Cast Metals." For further information, write Norman F. Hindle, Chicago Section, American Foundrymen's Association, 222 W. Adams St., Chicago, Ill.

MARCH 28—Machine Shop Practice Meeting of the Chicago Section of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in the Engineering Building, 205 W. Wacker Drive, Chicago, Ill. C. B. Cole, Tool Equipment Sales Co., 4625 Fulton St., Chicago, Ill., chairman.

JUNE 16-20—Summer meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Greenbrier Hotel, White Sulphur Springs, W. Va. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

JUNE 19-21—Summer meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS to be held in Cincinnati, Ohio. Clarence E. Davies, secretary, 29 W. 39th St., New York City.

JUNE 24-28—Thirty-eighth annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Book-Cadillac Hotel, Detroit, Mich., in conjunction with an exhibit of testing apparatus and related equipment. Secretary's address, 260 S. Broad St., Philadelphia.

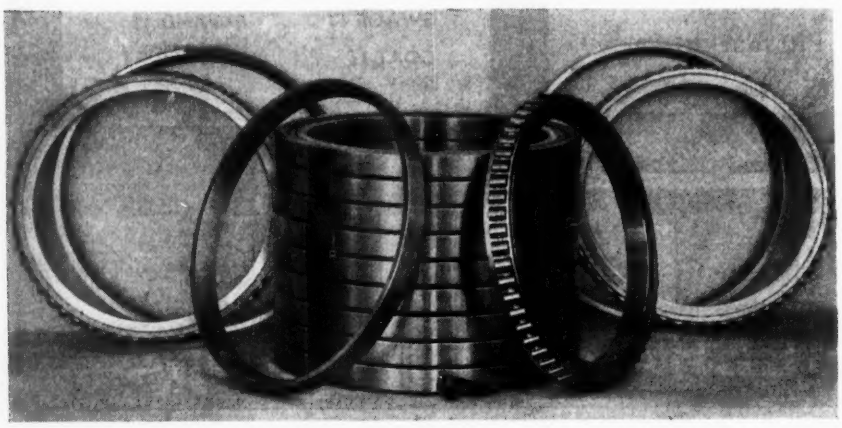
JUNE 25-27—GREAT LAKES POWER SHOW on the Steamer *Seeandbee*, exhibiting at Buffalo, June 25; at Cleveland, June 26; and at Detroit, June 27. Ernest H. Smith, manager, 3910 Carnegie Ave., Cleveland, Ohio.

JULY 15-20—INTERNATIONAL CONGRESS FOR SCIENTIFIC MANAGEMENT in London, England. For further information, address Industrial Development Association, British Empire Bldg., 620 Fifth Ave., New York City.

AUGUST 19-23—Convention of the AMERICAN FOUNDRYMEN'S ASSOCIATION at Toronto, Canada, with headquarters at Hotel Royal York. C. E. Hoyt, executive secretary-treasurer, 222 W. Adams St., Chicago, Ill.

SEPTEMBER 11-21—MACHINE TOOL EXPOSITION to be held in Cleveland, Ohio, under the auspices of the National Machine Tool Builders' Association, 1220 Guarantee Title Bldg., Cleveland, Ohio.

SEPTEMBER 30-OCTOBER 4—NATIONAL METAL EXPOSITION AND CONGRESS under the auspices of the American Society for Metals to be held in the International Amphitheatre, 43rd and Halsted Sts., Chicago, Ill. W. H. Eisenman, secretary, American Society for Metals, 7016 Euclid Ave., Cleveland, Ohio.



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